

DRAFT

Redwood Creek Watershed Synthesis Report



The mission of the North Coast Watershed Assessment Program is to conserve and improve California's north coast anadromous salmonid populations by conducting, in cooperation with public and private landowners, systematic multi-scale assessments of watershed conditions to determine factors affecting salmonid production and recommend measures for watershed improvements.

REDWOOD CREEK

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I. GENERAL BASIN DESCRIPTION

The Redwood Creek watershed is a narrow strip of land approximately fifty miles long and as narrow as five miles and lies entirely within Humboldt County. The exterior limits of the drainage basin virtually delineate the boundaries of the unit. The Klamath and Trinity Rivers border Redwood Creek on the north and east, and the Mad River on the south with the creeks terminus at the Pacific Ocean. Elevation within the basin varies from sea level at the terminus to 5045 feet at the headwaters at Board Camp Butte. Approximately half way up the basin, twenty to twenty five miles, Beaver and Wiregrass Ridges to the east and west are about 3500 feet.

Except for a relatively small coastal plain area and even smaller interior valleys, the terrain of the Redwood watershed is composed of steep and for the most part, inaccessible mountains. Redwood Creek flows from its headwaters in eastern Humboldt County in a northwesterly course to the Pacific Ocean near the northwestern corner of the county. The drainage area is approximately 285 square miles.

The climate of the Redwood Creek basin varies drastically from the moderate seasons along the coastal regions to the more extreme seasons common to the higher inland areas. The lower portion of the basin, extending some ten to twenty miles inland, the predominant influence on the climate is the moist marine air mass, which is moved inland by the prevailing onshore winds. This oceanic influence has a great moderating effect on the climate of the coastal areas. Temperatures in the coastal region of the Redwood Creek basin vary only slightly, with a difference of only ten to fifteen degrees Fahrenheit. The inland portion of the basin is enough removed from the oceanic influence, both by elevation and intervening ridges that it is not influenced by the marine air mass. The temperatures of the inland regions range from below freezing to above 100 degrees Fahrenheit.

The headwaters region of the Redwood Creek watershed can accumulate fairly large snow pack and this may have an effect on high flow events given the right conditions. However, it is very difficult to quantify the runoff rate of the snow pack during rain-on-snow events.

The Department of Water Resources, DWR, Statewide Planning Program delineates the Redwood watershed within the North Coast Hydrologic Region (HR), the Coastal (#03) Planning Subarea (PSA), and the Redwood Creek (#28) Detailed Analysis Unit (DAU). The USGS delineates the Redwood watershed within Hydrologic Unit #18010102.

II. PRECIPITATION

The climate within the Redwood basin is characterized by moderate temperatures in the summer and profuse rainfall patterns during the winter. Winter storms move inland in a northeasterly direction from the Pacific Ocean. Elevations in the upper Redwood Creek watershed exceed 5000 feet and precipitation occurs as snow. Rain-on-snow events may contribute to high flow events however; there is no data to quantify its contribution. The climate in the northeastern portion of the basin is influenced by the moist marine air mass with modest temperature and precipitation variance. The inland portion is removed from the oceanic influence with temperature varying from freezing to 100 degrees Fahrenheit and precipitation ranging from seventeen to ninety inches.

There are five precipitation gauges located within the Redwood Creek watershed. Only two of these gauges were in operation longer than twenty years with a cumulative operating time from 1951 to 2000. There are another 26 gauges located within ten miles of the watershed boundary. Table II-1 contains the gauge identifiers, location, period of record, annual, and maximum daily precipitation for the long-term gauges within or near the Redwood Creek watershed. Chart II-1 graphically illustrates the period of record for the gauges. Figure II-1 provides a location map. The mean annual precipitation for the gauges located within the Redwood basin is 54.35 inches. The maximum precipitation within the basin was 91.99 inches at the Westhaven, USFS station #F50 9560 40, in 1983 and the minimum precipitation was 14.72 at Orick, DWR station #F50 6498 20, in 1992.

Two of the longest operating precipitation gauges within the Redwood Creek watershed are the Orick 3NNE gauge, DWR station #F50 6497 00, at an elevation of 50 feet and the Redwood Creek O'Kane gauge, DWR station #F50 7352 00, located at an elevation of 850 feet. Chart II-2 shows the annual precipitation at the Orick 3NNE gauge along with the cumulative departure from the mean and a 10-point running average for water years 1951 -1992. The mean for the 42-year record is 67.10 inches. The wettest year was 1983 with 98.68 inches of rainfall. The driest year was 1983 with 32.65 inches of rainfall. Chart II-3 shows the annual precipitation at the Redwood Creek O'Kane gauge along with the cumulative departure from the mean for water years 1975 - 2000. The mean for the 58-year record is 50.69 inches. The wettest year was 1997 when 77.90 inches fell. The driest year was 1977 when 17.70 inches fell.

Table II-1: Existing And Discontinued Long-Term Precipitation Gauges Within And Near The Redwood Creek Watershed.

EXISTING AND DISCONTINUED LONG-TERM PRECIPITATION GAUGES LOCATED WITHIN OR NEAR THE REDWOOD CREEK RIVER WATERSHED						
Station Name	Orick 3NNE /1	Redwood Creek O'Kane /1	Klamath	Trinidad Head Light House	Kneeland	Hoopla
Station #	F50 6497 00	F50 7352 00	F30 4577 00	F50 9021 01	F60 4587 00	F40 4082 00
GAUGE LOCATION						
County	Humboldt	Humboldt	Del Norte	Humboldt	Humboldt	Humboldt
Longitude	124.042	123.817	124.033	124.152	123.917	123.667
Latitude	41.323	40.900	41.517	41.053	40.667	41.050
Elevation (ft)	50	850	25	198	2660	350
PERIOD OF RECORD						
Begin	1951	1975	1943	1901	1948	1941
End	1992 /2	2000 /3	2000	1941	1997	1999
ANNUAL PRECIPITATION						
Average	67.10	50.69	80.39	42.83	59.03	52.12
Maximum	98.68	77.90	119.07	71.51	82.14	97.00
Year	1983	1997	1974	1902	1974	1983
Minimum	32.65	17.70	33.85	23.33	31.30	21.17
Year	1992	1977	1977	1931	1977	1955
24-HOUR MAXIMUM PRECIPITATION						
Average	3.46	3.96	4.44	2.30	3.90	3.68
Maximum	5.22	9.00	8.98	4.10	11.03	10.63
Year	1975	2000	1999	1940	1996	1964
Minimum	1.82	1.60	1.96	1.10	1.90	2.00
Year	1973	1978	1987	1930	1968	1988
Notes: 1/	Gauge located within the Redwood Creek watershed.					
2/	Inactive 1966 - 1967.					
3/	Inactive 1982, 1990 -- 1995, & 1998 -- 1999.					

Chart II-1: Period Of Record For Precipitation Gauges Within And Near The Redwood Creek Watershed.

EXISTING AND DISCONTINUED LONG-TERM PRECIPITATION GAUGES LOCATED WITHIN OR NEAR THE REDWOOD CREEK WATERSHED											
Gauge Name	1900's	1910's	1920's	1930's	1940's	1950's	1960's	1970's	1980's	1990's	2000's
Orick 3NNE											
Redwood Creek O'Kane											
Klamath											
Trinidad Head Light House											
Kneeland											
Hoopla											

Chart II-2: Annual precipitation and cumulative departure from the mean for the Orick 3NNE rain gauge, DWR Station # F50 6497 00, for the period 1851 - 1992.

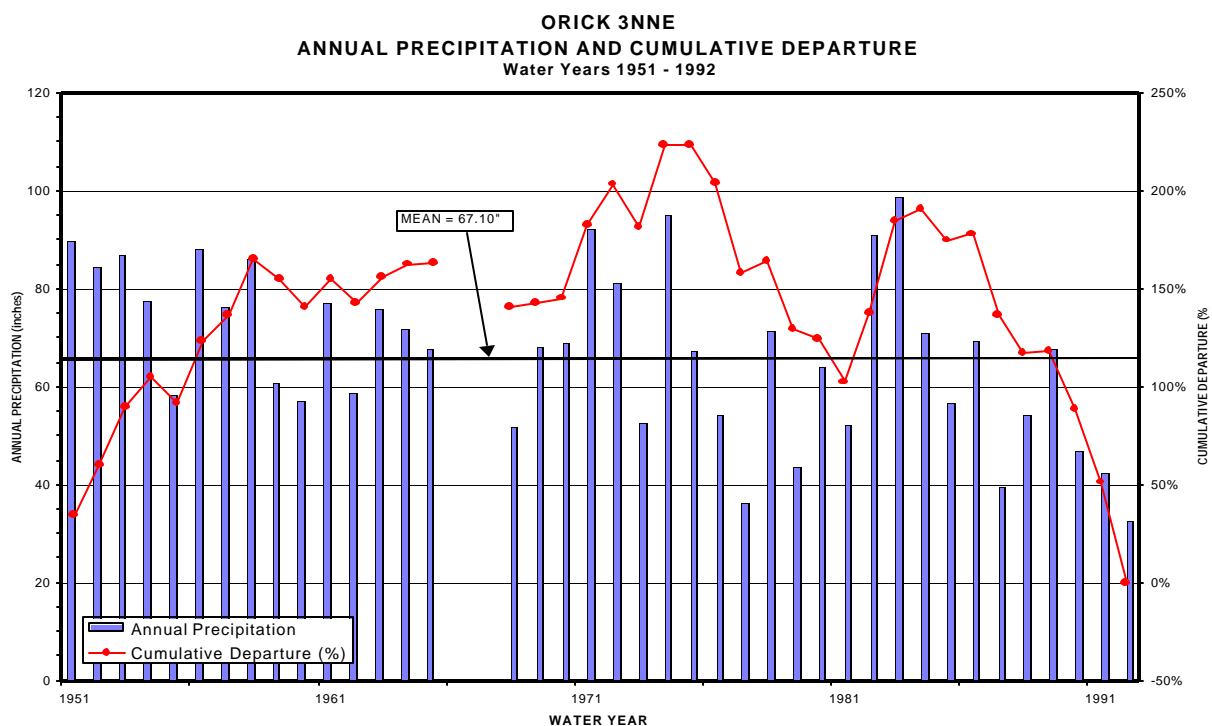
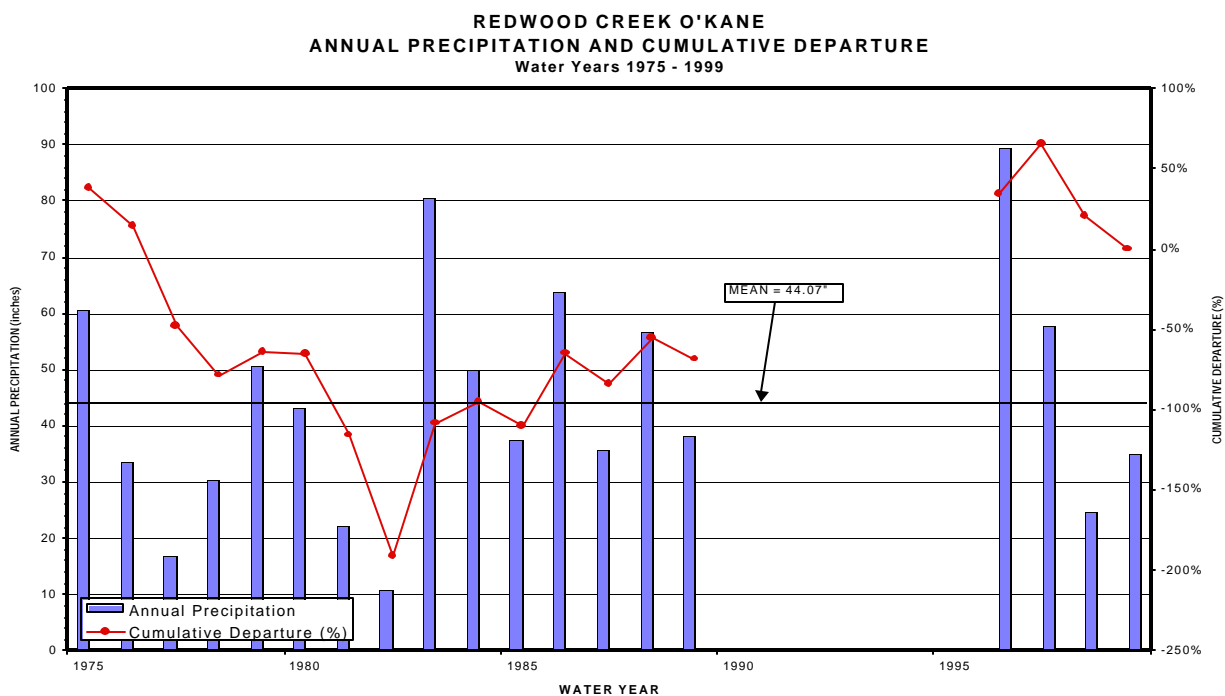
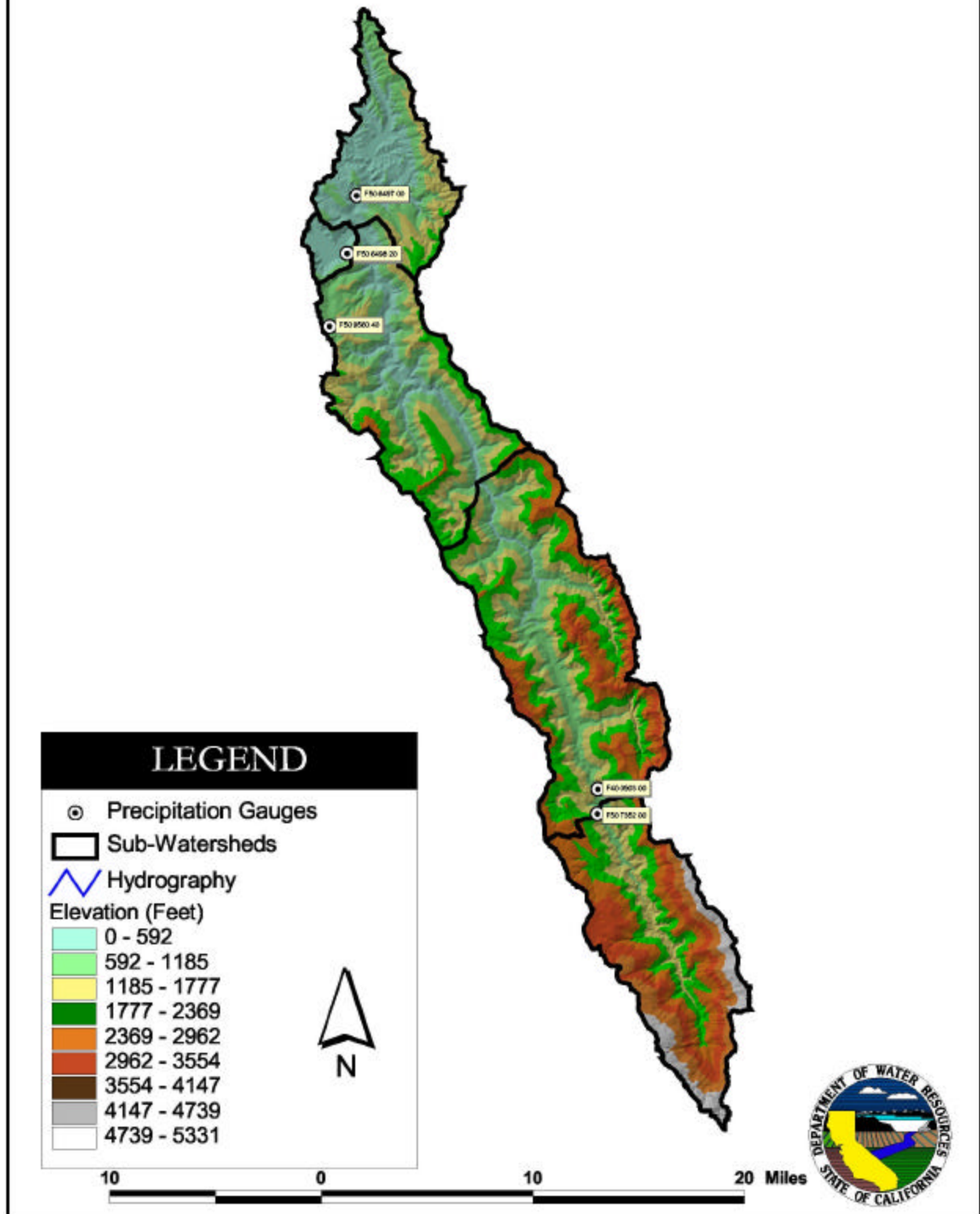


Chart II-3: Annual precipitation and cumulative departure from the mean for the Redwood Creek O'Kane rain gauge, DWR Station # F50 7352 00, for the period 1975 -2000.



**Figure II-1
Redwood Creek
Precipitation Gauge Location Map**



III. STREAM FLOW

Stream flow data are an important component in determining the existing conditions and assisting assessment, restoration, and management activities in North Coast watersheds. Stream flow can be a limiting factor for anadromous fisheries affecting migration and the quantity and quality of spawning, rearing, and refugia areas. Stream flow also has a direct affect on other factors such as water temperature, dissolved oxygen, and sediment and chemical transport. Stream flow data are required to quantify stream sediment and chemical transport total loads and for calibrating hydrologic or hydraulic computer models. Although floodplain management and instream structural design and installation projects are not included in NCWAP, stream flow data is a significant benefit to these as well as other activities including State Water Resources Control Board water right application and license reviews and judicial water supply allocations.

A common complaint of watershed managers is the lack of data and the inability to compare current flow conditions to historic conditions. If long-term data collection programs are not established and supported, water resource managers are forced to sometimes make profound policy, management, and operational decisions based on limited scientific data

Due to the general lack of stream flow data available within the North Coast region, funding was provided through NCWAP to install and operate stream-gauging stations. NCWAP will also provide for the continued operation of selected existing stream gauging stations that are subject to discontinuation due to funding reductions. Additional support for new stream gauging station installation and operation within North Coast watersheds will be provided by the State Water Resources Control Board Surface Water Ambient Monitoring Program (SWAMP). All new stream flow gauging stations will be equipped with water temperature sensors and some with other water quality sensors for measuring parameters such as turbidity, dissolved oxygen, pH, and conductance. Existing stations may also be equipped with additional water quality sensors. Certain selected stations will be equipped with telemetry to provide a portion of the collected data on a real-time basis via the California Data Exchange Center (CDEC) web site. Real-time stream flow and water quality data will assist in notifying this and other data collection efforts of event sampling opportunities or hazardous conditions for fish survival. Flood forecasters and emergency response personnel will also benefit.

Selection of sites, data collection type, and period of station operation will be based on available funding, existing stations, resumption of discontinued stations for historic comparisons, access, favorable site conditions, and special NCWAP or SWAMP identified needs. Stations located at the terminus of the watersheds or major subbasins where none currently exist will be a priority. Some stations will be operated for the long-term for trend and base correlation analysis, while others may only be operated for short periods. Electronic multiple parameter data loggers will be used at all stations to collect highly detailed time series data, normally every 15 minutes or hourly, for all sensors.

DWR and the USGS will work cooperatively to install and operate the new stream gauging stations. Data quality assurance and control techniques developed by the USGS will be employed. The stations will be constructed to withstand substantial flood events and incidental vandalism. Stations installed for short-term operation will be constructed with the assumption that data collection may be resumed at a later date. About 9 to 12 direct stream discharge measurements along with simultaneous water stage (elevation) data over a wide range of water stages will normally be performed annually at each station. High discharge measurements may require the installation of cableway systems if bridges are not located nearby or if

measurements by boat are impractical. Multiple direct field measurements of water stage and water quality parameters will also be performed to verify and calibrate the station sensors

Water stage and water quality time series data will normally be downloaded from the station data loggers and then uploaded into a database and reviewed and edited for accuracy on a monthly basis. Time series stream flow data will be determined by correlating the direct discharge measurements with the simultaneous water stage data. This stage vs. discharge relationship or rating curve is then applied to the stage recordings from the station's stage sensor and data logger to compute stream flow for the same time series interval as water stage, normally every 15 minutes. Once the rating curves are developed, real-time flow data will be provided through the Internet via the CDEC web site for those stations equipped with telemetry. Real-time telemetry also allows the station's operator to monitor the operation of the station remotely allowing a timely response to station malfunctions. Real-time data is normally not reviewed and edited for inaccuracies such as telemetry transmission error, sensor drift or malfunction, or discharge rating curve shift and is considered preliminary and subject to revision. Reviewed finalized data for the October through September water year will normally be available about three to six months after the end of the water year.

Unlike most North Coast watersheds, a number of stream flow gauging stations are currently being operated within the Redwood Creek watershed by the USGS and the U. S. Park Service. Therefore, no new stream gauging stations have been installed for NCWAP. However, at the request of the Park Service, NCWAP is funding collection of total suspended sediment and bedload transport data at the "Redwood Creek near Blue Lake" and "Redwood Creek at Orick" existing USGS stream gauging stations. This data will not be available until a later date. A list of the existing and discontinued stream flow gauging stations along with their location, flow data type, and period of record is shown in Table III-1. Chart III-1 graphically illustrates the period of record. A location map is provided in Figure III-1

Table III-1: Existing and discontinued stream flow gauging stations within the Redwood Creek watershed.

REDWOOD CREEK EXISTING AND DISCONTINUED STREAM FLOW GAUGING STATIONS							
Operating Agency	Station Number	Station Name	1/ Data Type	Drainage Area (sq. mi.)	Elevation (feet)	County	Period of Record
USGS	11481500	Redwood Creek near Blue Lake	QC	67.7	850	Humboldt	6/53 - 9/58 10/72 - 9/93 10/93 - 9/97 2/ 10/97 - present
USGS	11482000	Redwood Creek near Korbel	QC	83.0	NR	Humboldt	9/11 - 8/13
USGS	11482110	Lacks Creek near Orick	QC	16.9	480	Humboldt	10/80 - 10/91 11/91 - present 2/
USGS	11482120	Redwood Creek above Panther Creek near Orick	QC	150	400	Humboldt	10/80 - 10/89
USGS	11482125	Panther Creek near Orick	QC	6.07	400	Humboldt	10/79 - 10/91 11/91 - present 2/
USGS	11482130	Coyote Creek near Orick	QC	7.78	450	Humboldt	10/79 - 9/82 10/83 - 9/89 11/91 - 5/95 2/
USGS	11482200	Redwood Creek at South Park Boundary near Orick	QC	185	240	Humboldt	10/70 - 10/81
USGS	11482400	Prairie Creek Trib. near Klamath	QP	0.40	NR	Humboldt	12/61 - 1/73
USGS	11482468	Little Lost Man Creek at Site # 2 near Orick	QC	3.46	50	Humboldt	6/74 - 9/82 10/84 - 9/89 9/93 - present 2/
USGS	11482500	Redwood Creek at Orick	QC	277	5	Humboldt	9/11 - 9/13 10/53 - present
USPS 2/	NR	Prairie Creek below Brown Creek	QC	6.36	200	Humboldt	2/90 - present
USPS 2/	NR	Prairie Creek above Brown Creek	QC	4.06	280	Humboldt	2/90 - present
USPS 2/	NR	Prairie Creek above May Creek	QC	12.6	100	Humboldt	10/90 - present
USPS 2/	NR	Upper Brown Creek	QC	0.72	520	Humboldt	1/90 - 9/94
USPS 2/	NR	Lower Brown Creek	QC	1.4	280	Humboldt	1/90 - 6/95
USPS 2/	NR	Boyce Creek	QC	1.9	180	Humboldt	10/94 - 6/96
Notes: 1/ QP = annual peak flow only. QC = continuous flow record.							
2/ Station operated by the U. S. Park Service (USPS)							

Chart III-1: Period of record for stream flow gauging stations located within the Redwood Creek watershed.

REDWOOD CREEK EXISTING AND DISCONTINUED STREAM FLOW GAUGING STATIONS						
USGS Gauge #	Period of Record					
	1950's	1960's	1970's	1980's	1990's	2000's
11481500						
11482110						
11482120						
11482125						
11482130						
11482200						
11482400						
11482468						
11482500						

There are only two gauges within the Redwood Creek watershed with a period of operation long enough to be of statistical relevance for use in the frequency analysis. The two gauges are "Redwood Creek at Orick", USGS station #11482500, and "Redwood Creek near Blue Lake", USGS station #11481500.

The USGS have provided preliminary data for stage and discharge for the "Blue Lake" and "Orick" gauges for water year 2001. Final edited and reviewed data by the USGS for the entire water year is normally not available until three to six months after the end of the water year. Preliminary discharge data for the gauges operated by the USPS are not available at this time. Chart III-2 shows the discharge for the two USGS gauges for water year 2001.

A summary and statistical analysis of the long-term flow data for these stations follows.

Tables III-2 and III-3 show the mean monthly flows for the period of record for each station. Charts III-3 and III-4 graphically illustrate the mean, maximum, and minimum daily flows for each day of the water year for the period of record. Charts III-5 and III-6 shows the annual yield or runoff volume in acre-feet for the period of record and the cumulative departure from the mean of the daily mean for the period of record. Charts III-7 and III-8 presents daily flow duration for the period of record.

A frequency analysis for annual peak and low-flow was completed using the techniques from the USGS Bulletin number 17B, Techniques of Water-Resources Investigation of the USGS and Ven Te Chow's Handbook of Hydrology. The data used for the peak flow frequency were the annual instantaneous values. For this analysis the Gringorten plotting position equation was used, as it tended to give better results when using the normal distribution. Tables III-4 and III-5 show the ranked data, plotting position, and frequencies. Chart III-9 and III-10 show the peak discharge for the period of record with the 5-point moving average superimposed. The moving average describes the general behavior of the time series data. The information from Tables III-6 and III-7 is then utilized to graphically represent peak discharge in the form of return period. See Charts III-11 and III-12. The return period depicts the theoretical return period in years that the event will be equaled or exceeded.

The low-flow frequency analysis is similar to the peak-flow analysis except that the discharge values are found by calculating the minimum 7-day running average of the mean daily flows for each water year. These values are then used to complete the frequency analysis described above. Tables III-6 and III-7 show the ranked data, plotting position, and frequencies. Charts III-13 and III-14 show the low-flow for the period of record with the 5-percent moving average. Charts III-15 and III-16 represent the return periods.

Chart III-2: Redwood Creek Daily Discharge For Water Year 2001.

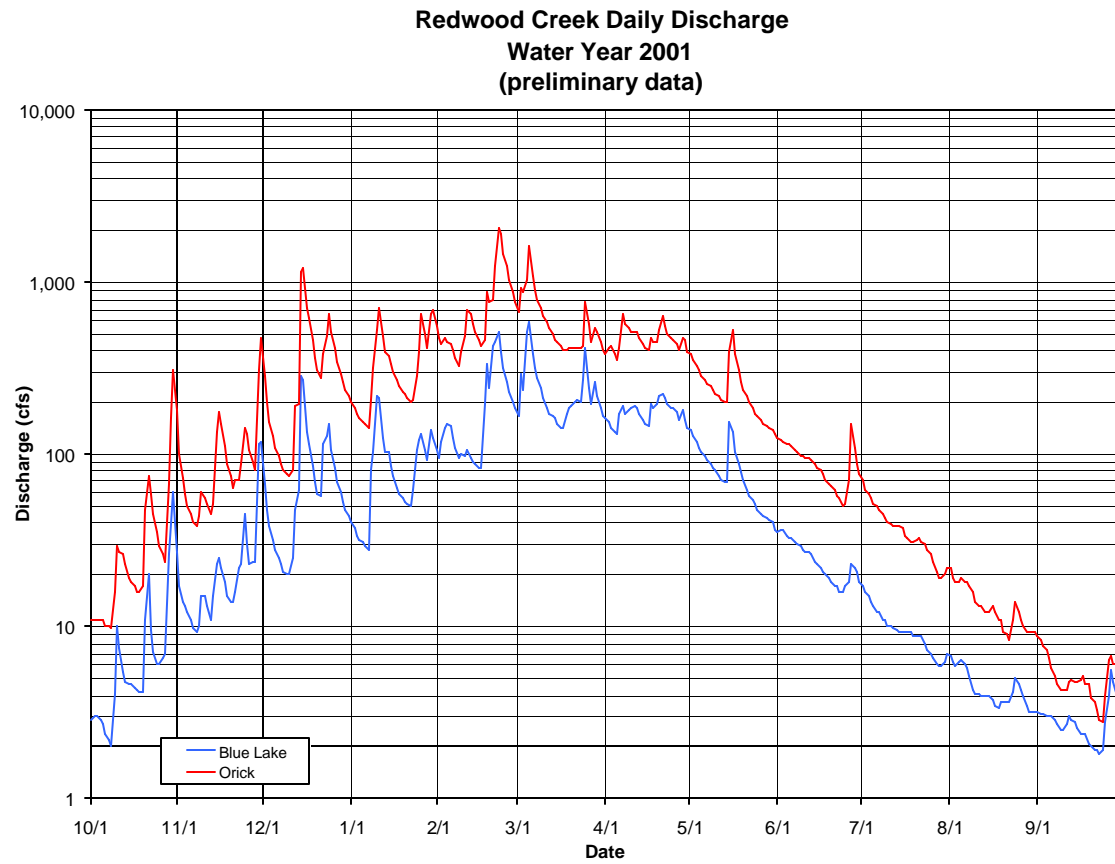


Table III-2: Summary of monthly mean discharge for the period of record for "Redwood Creek at Orick", USGS Station #11482500.

REDWOOD Creek at Orick, STA #11482500																	
Period of Record: (1912-1913, 1954-2000)																	
Mean of Mean Daily Flows (cfs)																	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Min (cfs)	Max (cfs)	Avg (cfs)	Total (cfs)	Total (AF)
1912	30	117	183	3,047	3,100	1,425	854	1,732	400	95	45	80	30	3,100	926	11,107	667,797
1913	80	3,000	2,500	3,450	773	762	1,500	574	200	120	45	26	26	3,450	1,086	13,031	787,250
1954	139	2,870	2,428	3,988	2,277	1,327	1,232	272	269	110	62	62	62	3,988	1,253	15,035	902,114
1955	68	497	2,049	2,348	884	833	1,415	715	177	79	34	36	34	2,348	761	9,136	552,252
1956	55	881	5,953	6,041	3,129	1,836	672	426	195	93	50	28	28	6,041	1,613	19,359	1,174,431
1957	468	457	1,435	1,412	1,837	4,255	1,193	1,069	368	135	57	45	45	4,255	1,060	12,722	767,266
1958	330	1,506	2,596	2,996	5,441	1,427	1,635	330	191	83	38	35	35	5,441	1,384	16,611	982,282
1959	31	326	439	2,606	3,087	1,258	800	232	113	57	25	40	25	3,087	751	9,013	533,302
1960	48	35	150	592	3,400	2,199	1,298	1,689	521	122	55	28	28	3,400	845	10,137	606,099
1961	37	1,164	1,513	546	3,224	3,615	1,121	1,419	304	116	55	35	35	3,615	1,096	13,148	784,072
1962	112	849	1,879	860	2,090	2,122	714	408	151	64	78	40	40	2,122	781	9,367	560,027
1963	1,559	1,070	2,295	409	2,250	1,436	4,026	1,325	240	96	46	29	29	4,026	1,232	14,781	884,803
1964	198	2,859	844	4,748	1,256	1,394	535	346	214	102	55	27	27	4,748	1,048	12,578	761,175
1965	24	1,237	8,981	4,259	870	372	1,111	341	133	56	33	19	19	8,981	1,453	17,437	1,062,012
1966	28	331	884	4,147	1,401	2,359	883	244	119	60	23	33	23	4,147	876	10,512	635,298
1967	44	980	2,375	2,739	1,331	1,866	1,707	1,062	275	96	38	24	24	2,739	1,045	12,538	757,077
1968	73	186	836	2,162	2,259	1,432	489	242	141	51	92	50	50	2,259	668	8,013	482,021
1969	95	1,267	3,288	3,620	3,146	1,226	946	485	170	76	38	28	28	3,620	1,199	14,386	861,068
1970	106	214	1,894	5,926	1,445	1,127	349	617	180	66	28	18	18	5,926	997	11,969	725,861
1971	61	2,473	3,549	3,554	846	3,654	1,649	543	238	114	50	95	50	3,654	1,402	16,825	1,020,678
1972	91	1,287	3,410	4,240	2,508	4,270	1,106	343	161	68	34	25	25	4,270	1,462	17,542	1,063,533
1973	32	293	1,907	2,366	1,420	1,813	948	238	100	45	21	92	21	2,366	773	9,274	558,948
1974	870	5,219	4,161	2,737	2,090	2,763	2,376	315	135	64	27	15	15	5,219	1,731	20,772	1,249,418
1975	19	101	1,184	2,362	4,048	5,565	1,375	837	179	75	37	22	19	5,565	1,317	15,804	944,309
1976	518	1,183	1,914	1,396	2,087	1,535	994	284	126	56	51	21	21	2,087	847	10,165	612,153
1977	18	64	42	180	190	844	286	337	134	48	23	134	18	844	192	2,300	139,075
1978	232	2,036	3,024	3,102	2,219	1,296	1,240	495	183	83	41	119	41	3,102	1,172	14,068	844,715
1979	31	71	270	1,018	1,981	1,508	1,199	1,279	202	76	32	25	25	1,981	641	7,693	458,251
1980	551	1,893	1,369	2,944	1,811	2,805	1,118	456	184	82	30	17	17	2,944	1,105	13,261	801,854
1981	32	102	1,113	1,275	1,891	1,759	952	364	202	75	35	26	26	1,891	652	7,826	467,399
1982	231	2,311	4,986	2,409	3,131	1,874	3,730	450	142	64	27	14	14	4,986	1,614	19,369	1,160,021
1983	185	1,185	4,581	2,392	4,633	3,594	1,993	798	229	161	90	97	90	4,633	1,661	19,937	1,191,380
1984	54	2,714	5,470	1,075	2,269	1,913	1,594	1,267	484	116	56	27	27	5,470	1,420	17,040	1,029,185
1985	152	3,398	1,562	436	1,577	966	752	208	177	44	20	21	20	3,398	776	9,311	554,483
1986	146	357	1,107	1,573	6,320	2,345	473	744	174	69	25	149	25	6,320	1,124	13,482	789,100
1987	108	327	612	1,592	1,704	1,897	456	188	77	36	12	6	6	1,897	584	7,014	419,415
1988	3	72	2,277	2,336	509	297	251	349	857	139	49	20	3	2,336	597	7,159	435,795
1989	17	1,700	1,289	2,699	1,145	3,318	1,445	378	194	84	39	25	17	3,318	1,028	12,334	744,873
1990	93	99	131	1,698	2,166	1,545	440	755	827	135	64	37	37	2,166	666	7,989	475,575
1991	25	58	163	552	685	1,709	1,021	568	224	91	39	21	21	1,709	430	5,156	310,300
1992	37	106	267	337	1,119	703	853	214	82	39	10	4	4	1,119	314	3,773	225,492
1993	22	264	1,360	3,155	1,868	2,225	2,481	1,382	1,213	194	84	35	22	3,155	1,190	14,283	859,182
1994	33	41	968	1,082	1,552	782	463	382	170	58	23	13	13	1,552	464	5,567	331,724
1995	14	815	1,591	4,427	1,472	3,331	2,002	913	344	134	51	27	14	4,427	1,260	15,121	914,668
1996	28	62	3,409	4,613	2,705	2,243	1,708	868	292	92	31	23	23	4,613	1,339	16,073	973,440
1997	78	761	5,726	4,276	1,465	1,000	865	541	181	78	35	78	35	5,726	1,257	15,084	915,029
1998	157	700	1,236	4,385	4,594	2,143	1,240	637	312	121	48	23	23	4,594	1,300	15,596	927,138
1999	52	2,350	2,280	2,103	3,945	2,639	1,395	698	204	82	38	16	16	3,945	1,317	15,802	940,300
2000	28	282	929	3,161	2,618	1,483	453	579	209	81	33	19	19	3,161	823	9,876	589,741
Min	3	35	42	180	190	297	251	188	77	36	10	4					
Max	1,559	5,219	8,981	6,041	6,320	5,565	4,026	1,732	1,213	194	92	149					
Avg	154	1,081	2,156	2,546	2,232	1,971	1,227	633	258	87	42	40					

Table III-3: Summary of monthly mean discharge for the period of record for "Redwood Creek near Blue Lake", USGS Station #11481500.

USGS 11481500 REDWOOD C NR BLUE LAKE CA																	
Period of Record: (1954-1958, 1973-1993, 1998-2000)																	
Mean of Mean Daily Flows (cfs)																	
Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	(cfs)	(cfs)	(cfs)	(cfs)	Total (AF)
1954	23	543	546	824	530	340	300	71	86	30	14	11	11	824	276	3,318	198970
1955	13	91	386	370	215	198	284	234	57	24	10	9	9	386	158	1,892	114158
1956	11	172	1,563	1,628	730	422	250	176	62	22	12	8	8	1,628	421	5,058	307101
1957	107	75	235	309	510	1,052	326	284	85	31	14	13	13	1,052	253	3,038	182798
1958	94	529	781	888	1,479	398	441	115	58	21	10	8	8	1,479	402	4,822	285634
1973	10	106	407	546	410	414	274	74	39	12	5	24	5	546	193	2,320	139366
1974	226	1,179	977	673	589	689	464	82	36	15	6	4	4	1,179	412	4,941	296976
1975	5	21	312	752	1,096	1,306	300	229	59	26	11	6	5	1,306	344	4,124	246268
1976	129	245	318	264	516	364	252	86	33	13	13	7	7	516	187	2,240	134624
1977	6	15	12	31	42	183	92	87	34	11	5	10	5	183	44	529	31967
1978	25	290	597	808	490	400	326	122	44	20	8	17	8	808	262	3,147	189236
1979	7	18	56	265	380	356	278	248	52	22	8	5	5	380	141	1,696	101317
1980	132	455	248	746	539	592	312	119	58	24	10	6	6	746	270	3,241	195516
1981	13	22	227	265	403	374	218	90	44	17	7	7	7	403	141	1,687	100746
1982	50	568	1,084	521	727	423	748	175	45	18	9	7	7	1,084	365	4,374	261933
1983	55	343	900	605	1,051	914	498	250	62	36	27	26	26	1,051	397	4,765	284919
1984	12	645	1,180	242	509	497	430	304	96	26	12	7	7	1,180	330	3,959	239091
1985	30	771	382	112	364	213	241	62	39	11	5	6	5	771	186	2,237	133259
1986	26	83	260	357	1,443	568	116	162	41	16	5	29	5	1,443	259	3,106	181871
1987	17	74	144	294	402	408	151	57	22	11	5	2	2	408	132	1,587	94689
1988	2	24	485	413	140	81	63	101	174	30	10	5	2	485	127	1,528	92851
1989	5	381	198	549	302	898	370	94	39	16	10	8	5	898	239	2,871	173139
1990	27	30	32	382	412	395	118	176	179	33	11	8	8	412	150	1,804	107780
1991	8	17	44	112	118	322	237	147	57	21	11	5	5	322	92	1,100	66314
1992	8	26	53	86	224	160	182	53	27	11	3	2	2	224	70	836	50074
1993	5	41	343	704	400	416	519	337	253	46	15	3	3	704	257	3,083	185553
1998	28	158	317	1,123	1,143	638	319	199	103	28	8	4	4	1,143	339	4,067	242113
1999	7	380	489	459	935	623	392	236	55	18	8	3	3	935	301	3,606	214526
2000	5	57	167	615	650	362	162	157	55	19	7	5	5	650	188	2,261	134581
Min	2	15	12	31	42	81	63	53	22	11	3	2					
Max	226	1,179	1,563	1,628	1,479	1,306	748	337	253	46	27	29					
Avg	39	261	449	512	575	487	304	156	69	22	10	9					

Chart III-3: Mean, maximum, and minimum daily flow for each day of the water year for the period of record for "Redwood Creek at Orick", USGS Station #11482500.

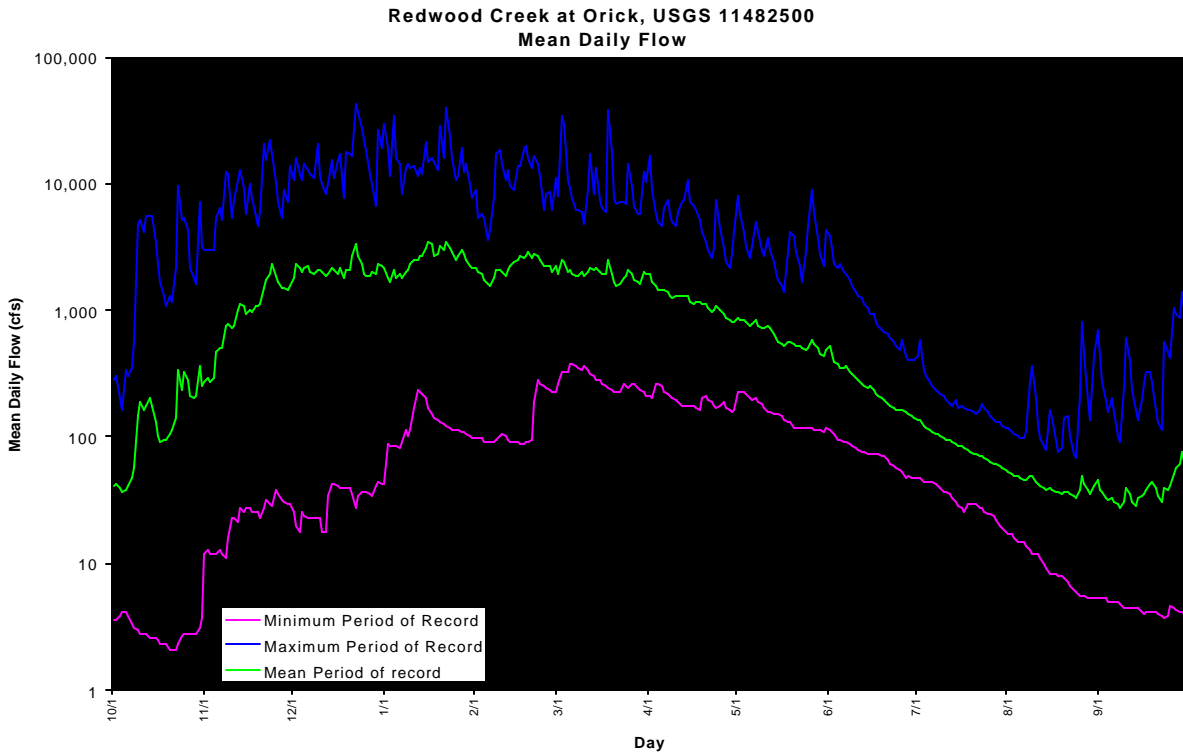


Chart III-4: Mean, maximum, and minimum daily flow for each day of the water year for the period of record for "Redwood Creek near Blue Lake", USGS Station #11481500.

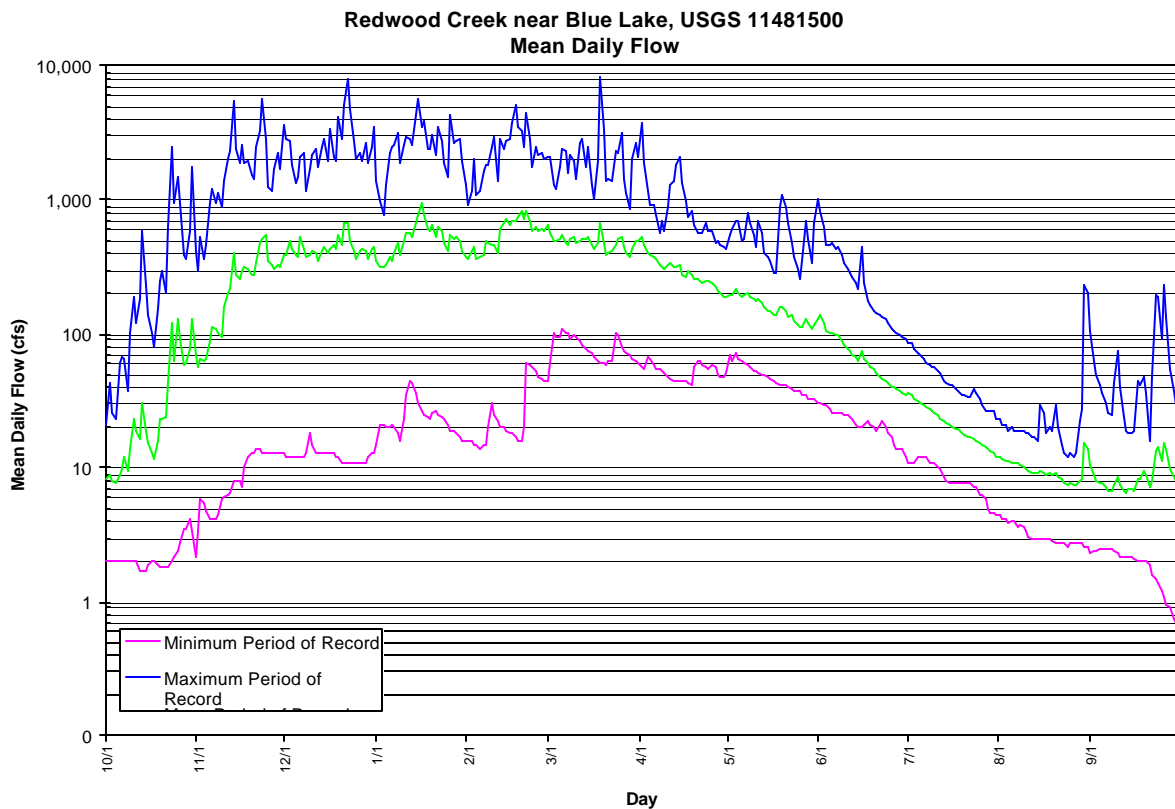


Chart III-5: Annual yield and cumulative departure from the mean for the period of record for "Redwood Creek at Orick", USGS Station #11482500.

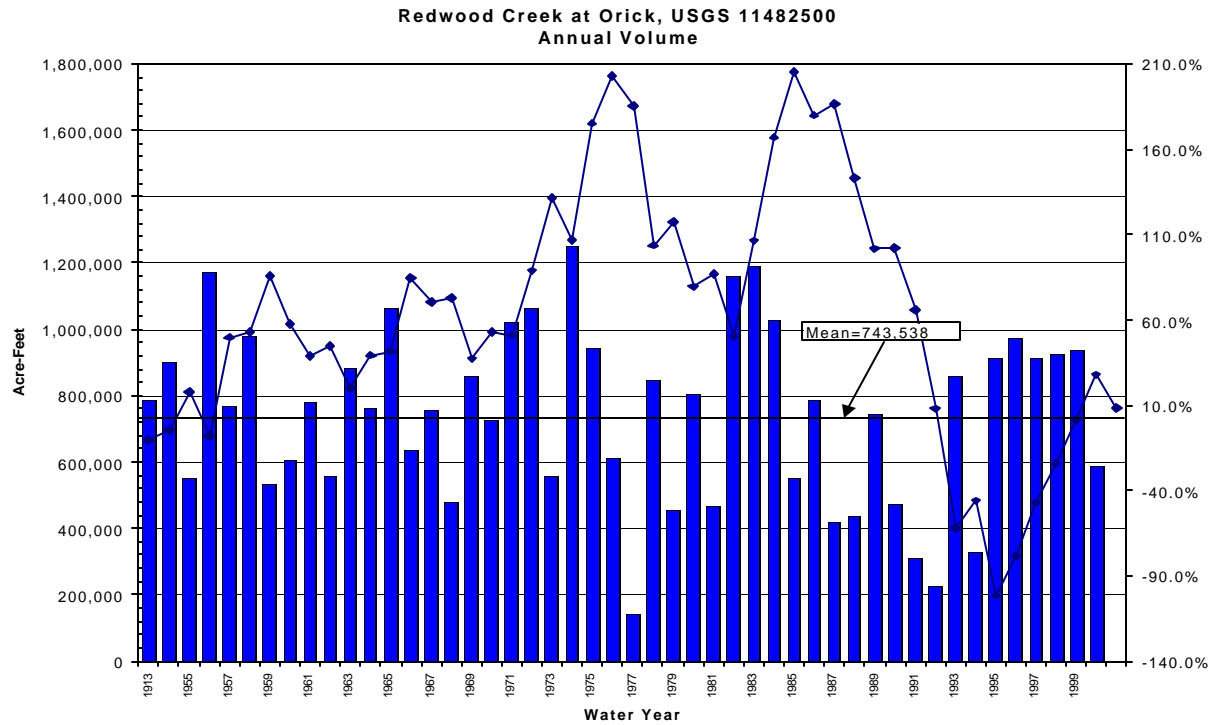


Chart III-6: Annual yield and cumulative departure from the mean for the period of record for "Redwood Creek near Blue Lake", USGS Station #11481500.

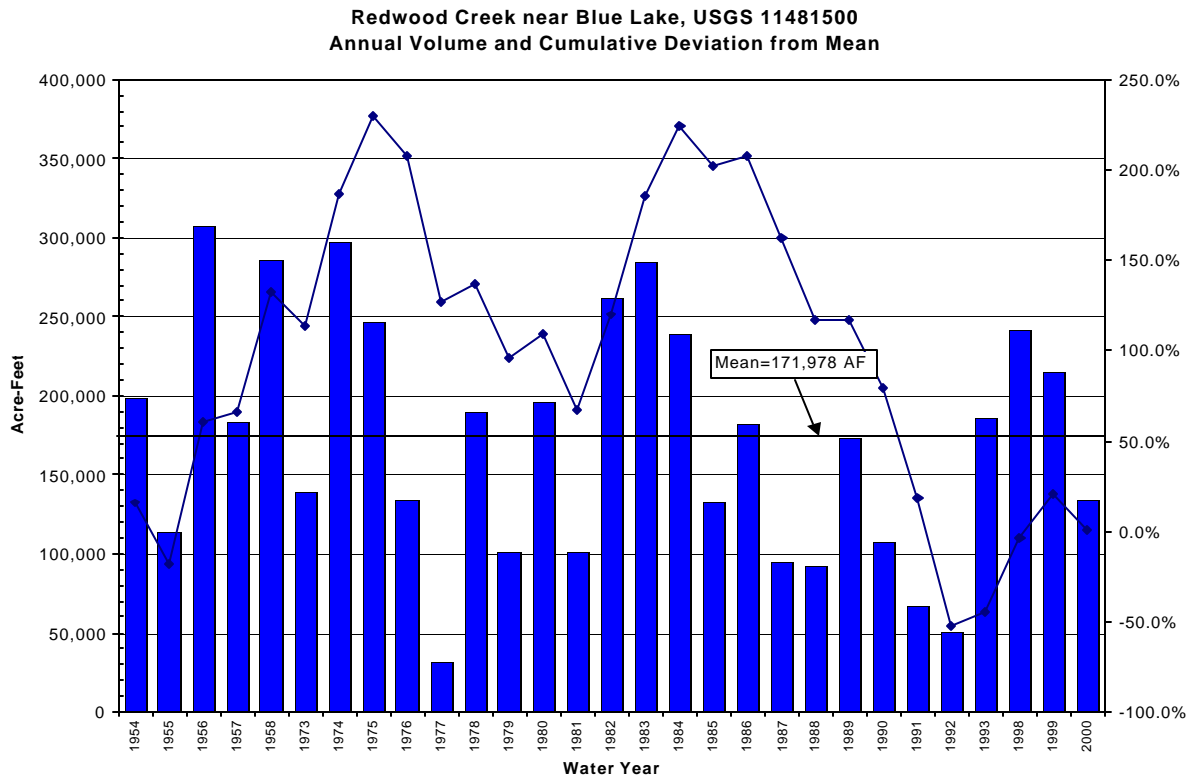


Chart III-7: Daily Flow Duration For The Period Of Record For “Redwood Creek At Orick” USGS Station #11482500.

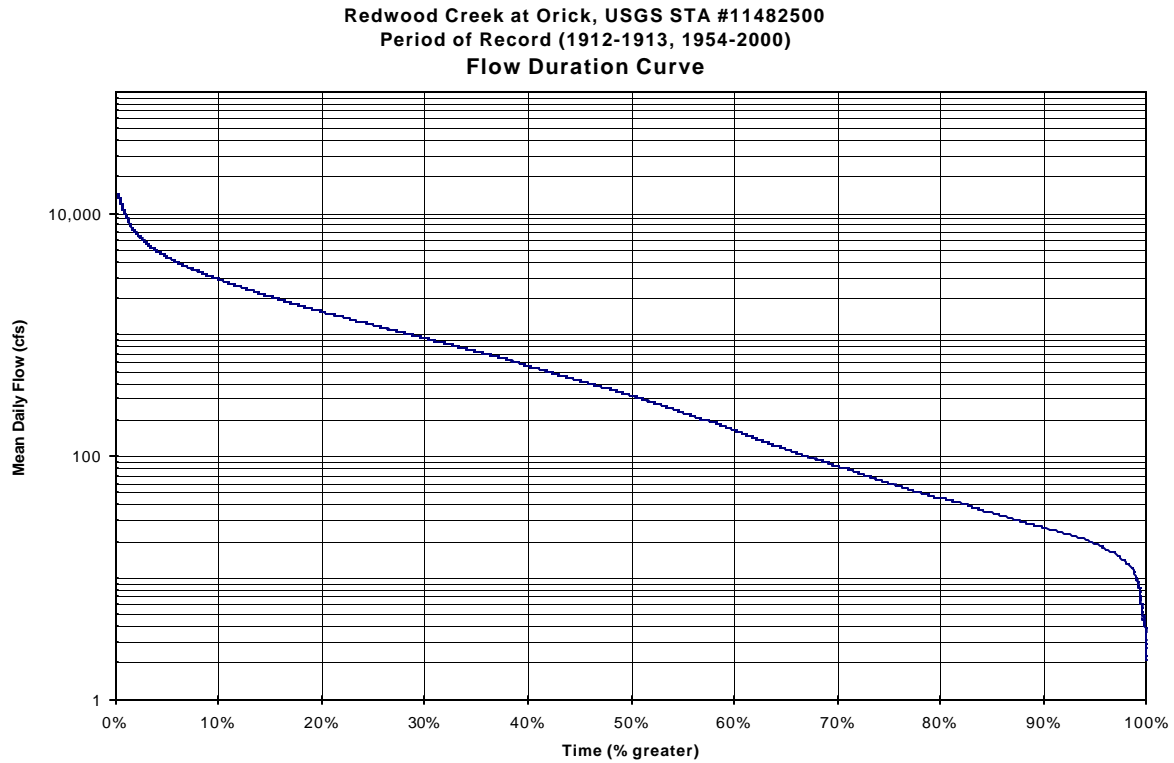


Chart III-8: Daily Flow Duration For The Period Of Record For “Redwood Creek Near Blue Lake” USGS Station #11481500.

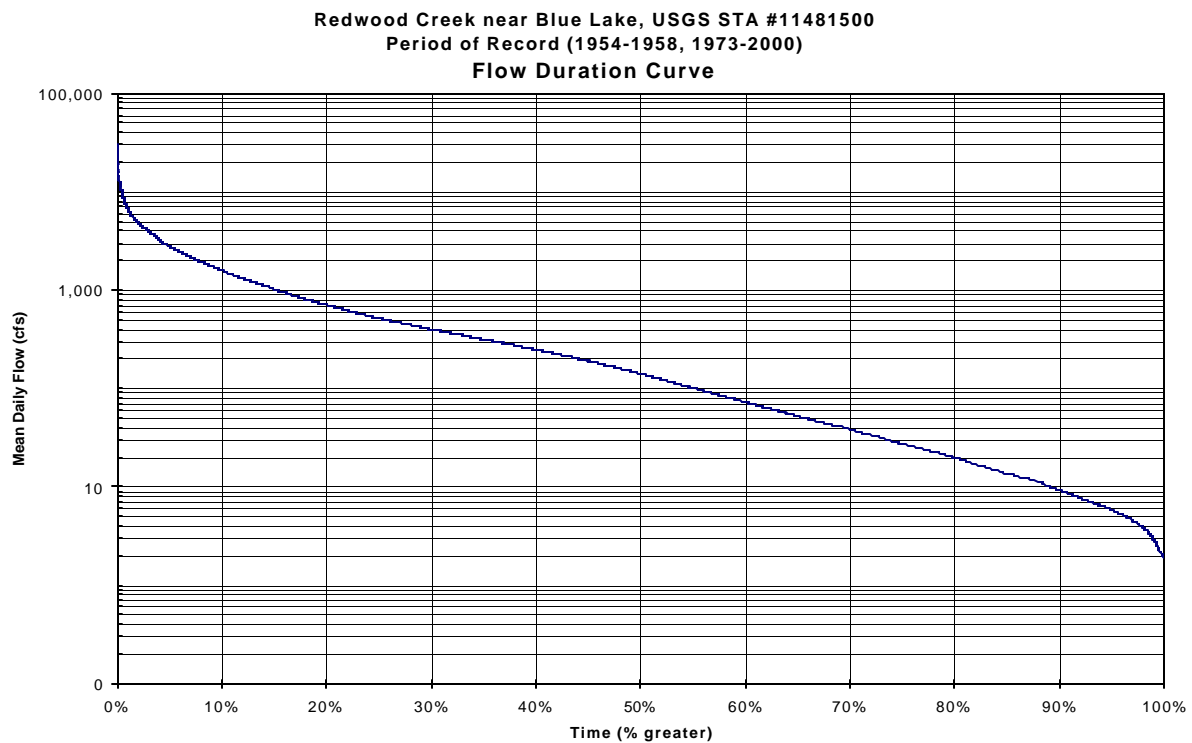


Table III-4: Annual peak instantaneous discharge and frequency analysis for the period of record for "Redwood Creek at Orick", USGS Station #11482500.

PEAK DISCHARGE FREQUENCY ANALYSIS Redwood @ Orick, USGS STA# 11482500 PERIOD OF RECORD--WATER YEARS (1912-1913, 1954-2000)						
PEAK DISCHARGE			FREQUENCY ANALYSIS			STATISTICS
Rank	Water Year	Peak Discharge (cfs)	Girgorten Plotting Position	Frequency	Exceedence Probability	
1	1965	50500	87.71	0.989	0.011	Statistical Moments of Discharge Mean = 22722.04 SDEV = 12064.05 Variance = 1.46E+08 Skew = 0.74
2	1975	50200	31.49	0.968	0.032	
3	1956	50000	19.19	0.948	0.052	
4	1972	49700	13.80	0.928	0.072	
5	1997	40300	10.77	0.907	0.093	
6	1966	39600	8.83	0.887	0.113	
7	1964	37700	7.49	0.866	0.134	
8	1996	31800	6.50	0.846	0.154	
9	1999	31000	5.74	0.826	0.174	
10	1986	30700	5.14	0.805	0.195	
11	1971	30500	4.65	0.785	0.215	
12	1983	29500	4.25	0.765	0.235	
13	1955	28100	3.91	0.744	0.256	
14	1970	28000	3.62	0.724	0.276	
15	1954	27200	3.37	0.704	0.296	
16	1982	26500	3.16	0.683	0.317	
17	1963	26100	2.97	0.663	0.337	
18	1960	24900	2.80	0.643	0.357	
19	1974	24800	2.65	0.622	0.378	
20	1967	24500	2.51	0.602	0.398	
21	1957	24100	2.39	0.581	0.419	
22	1958	22200	2.28	0.561	0.439	
23	1962	21800	2.18	0.541	0.459	
24	1989	21400	2.08	0.520	0.480	
25	1978	21200	2.00	0.500	0.500	
26	1998	19900	1.92	0.480	0.520	
27	2000	19900	1.85	0.459	0.541	
28	1912	19500	1.78	0.439	0.561	
29	1980	19400	1.72	0.419	0.581	
30	1995	18600	1.66	0.398	0.602	
31	1990	18100	1.61	0.378	0.622	
32	1984	17900	1.56	0.357	0.643	
33	1959	17500	1.51	0.337	0.663	
34	1969	17200	1.46	0.317	0.683	
35	1988	15200	1.42	0.296	0.704	
36	1968	14900	1.38	0.276	0.724	
37	1961	14700	1.34	0.256	0.744	
38	1979	14100	1.31	0.235	0.765	
39	1913	12500	1.27	0.215	0.785	
40	1976	12100	1.24	0.195	0.805	
41	1993	11800	1.21	0.174	0.826	
42	1985	11400	1.18	0.154	0.846	
43	1973	10000	1.15	0.134	0.866	
44	1981	9030	1.13	0.113	0.887	
45	1994	7890	1.10	0.093	0.907	
46	1987	5870	1.08	0.072	0.928	
47	1991	5280	1.05	0.052	0.948	
48	1992	5000	1.03	0.032	0.968	
49	1977	3310	1.01	0.011	0.989	

Table III-5: Annual peak instantaneous discharge and frequency analysis for the period of record for "Redwood Creek near Blue Lake", USGS Station #11481500.

PEAK DISCHARGE FREQUENCY ANALYSIS Redwood near Blue Lake, USGS STA# 11481500 PERIOD OF RECORD--WATER YEARS (1954-1958, 1973-1993, 1998-2000)						
PEAK DISCHARGE			FREQUENCY ANALYSIS			STATISTICS
Rank	Water Year	Peak Discharge (cfs)	Gringorten Plotting Position	Frequency	Exceedence Probability	
1	1975	12200	52.00	0.981	0.019	Statistical Moments of Discharge Mean = 5343.34 SDEV = 2768.62 Variance = 7.67E+06 Skew = 0.82
2	1956	12100	18.67	0.946	0.054	
3	1955	9200	11.38	0.912	0.088	
4	1954	8310	8.18	0.878	0.122	
5	1958	7960	6.39	0.843	0.157	
6	1998	7000	5.24	0.809	0.191	
7	1983	6750	4.44	0.775	0.225	
8	1986	6470	3.85	0.740	0.260	
9	1989	5980	3.40	0.706	0.294	
10	1990	5980	3.05	0.672	0.328	
11	1957	5890	2.76	0.637	0.363	
12	1982	5730	2.52	0.603	0.397	
13	1974	5720	2.32	0.569	0.431	
14	1993	5340	2.15	0.534	0.466	
15	1980	4840	2.00	0.500	0.500	
16	1979	4760	1.87	0.466	0.534	
17	1999	4470	1.76	0.431	0.569	
18	1985	4390	1.66	0.397	0.603	
19	2000	4390	1.57	0.363	0.637	
20	1976	4100	1.49	0.328	0.672	
21	1984	3950	1.42	0.294	0.706	
22	1988	3900	1.35	0.260	0.740	
23	1978	3490	1.29	0.225	0.775	
24	1981	3410	1.24	0.191	0.809	
25	1973	2980	1.19	0.157	0.843	
26	1987	2020	1.14	0.122	0.878	
27	1991	1430	1.10	0.088	0.912	
28	1992	1370	1.06	0.054	0.946	
29	1977	827	1.02	0.019	0.981	

Chart III-9: Instantaneous Annual Peak Discharge And 5-Point Moving Average To Show The Runoff Trend For The Period Of Record. "Redwood Creek At Orick", USGS Station #11482500.

Redwood @ Orick for POR, STA#11482500

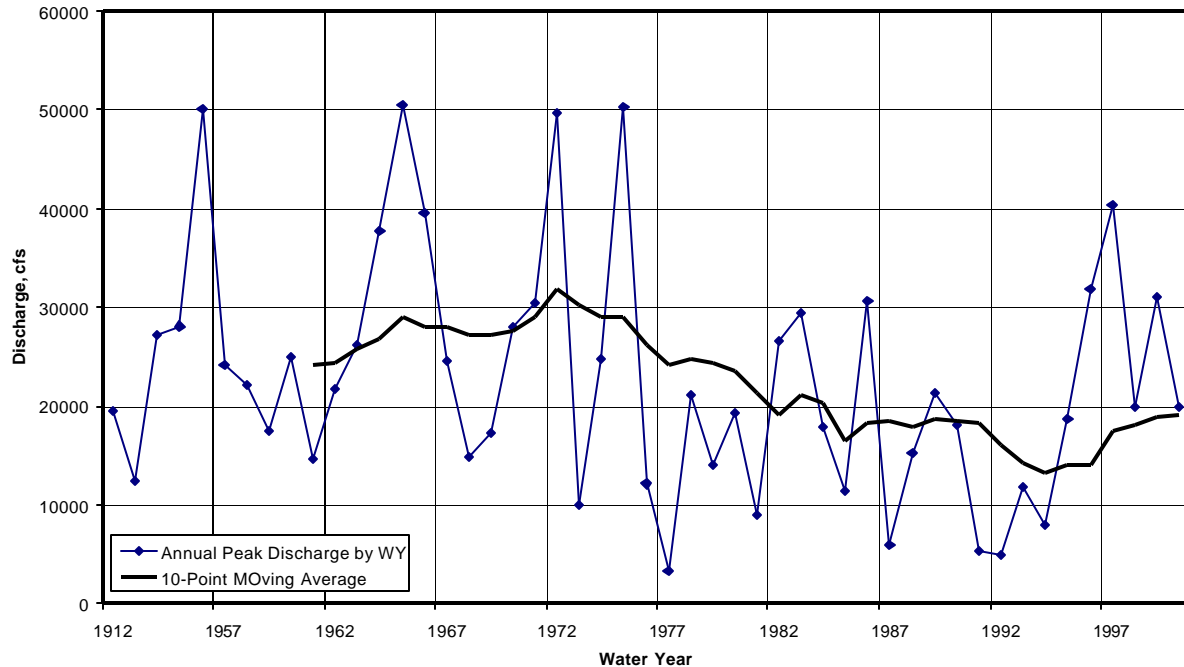


Chart III-10: Instantaneous Annual Peak Discharge And 5-Point Moving Average To Show Runoff Trend For The Period Of Record. "Redwood Creek Near Blue Lake", USGS Station #11481500.

Redwood Creek near Blue Lake, STA #11481500
Peak Discharge for Period of Record, (1954-1958, 1973-1993, 1998-2000)

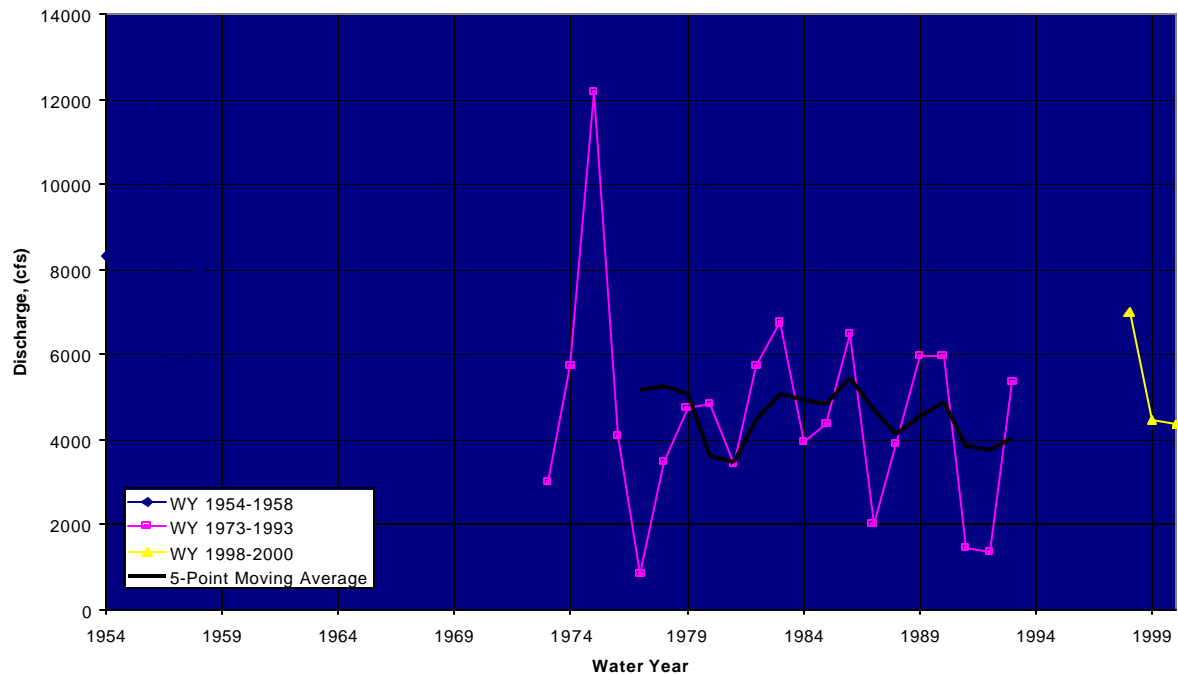


Chart III-11: Peak Flow Return Period. Graph Shows The Theoretical Return Period In Years That A Given Value Will Be Equaled Or Exceeded For "Redwood Creek At Orick", USGS Station #11482500.

REDWOOD CREEK AT ORICK, RETURN PERIODS, STA #11482500

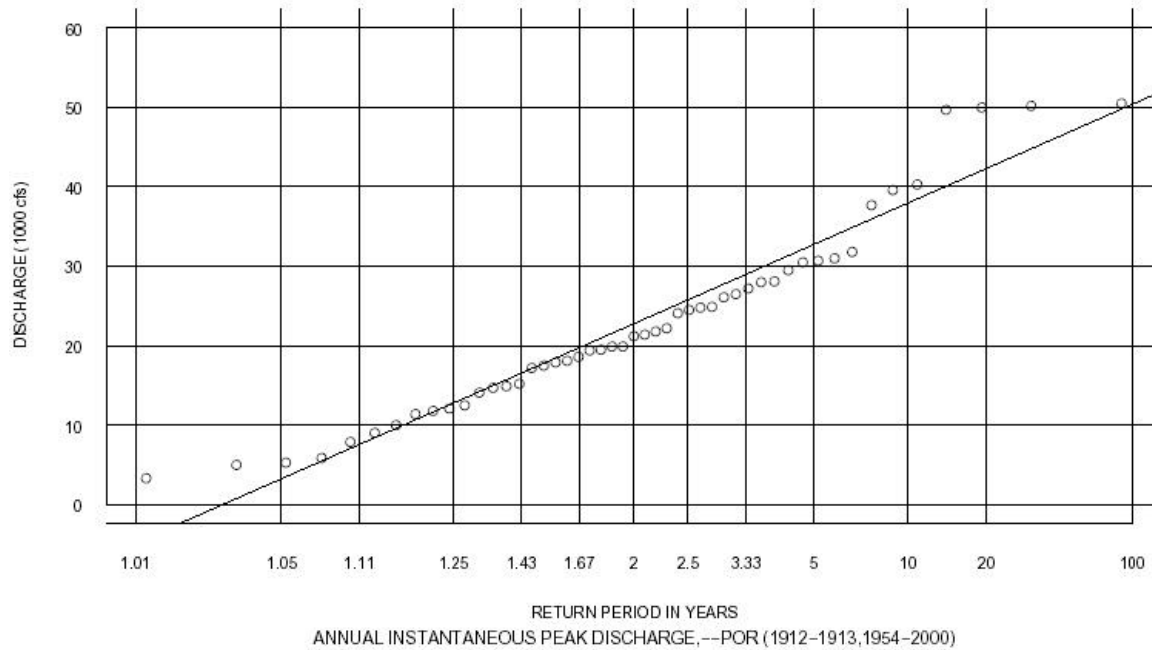


Chart III-12: Peak Flow Return Period. Graph Shows The Theoretical Return Period In Years That A Given Value Will Be Equaled Or Exceeded For "Redwood Creek Near Blue Lake", USGS Station #11481500.

REDWOOD CREEK NEAR BLUE LAKE, RETURN PERIOD STA #11481500

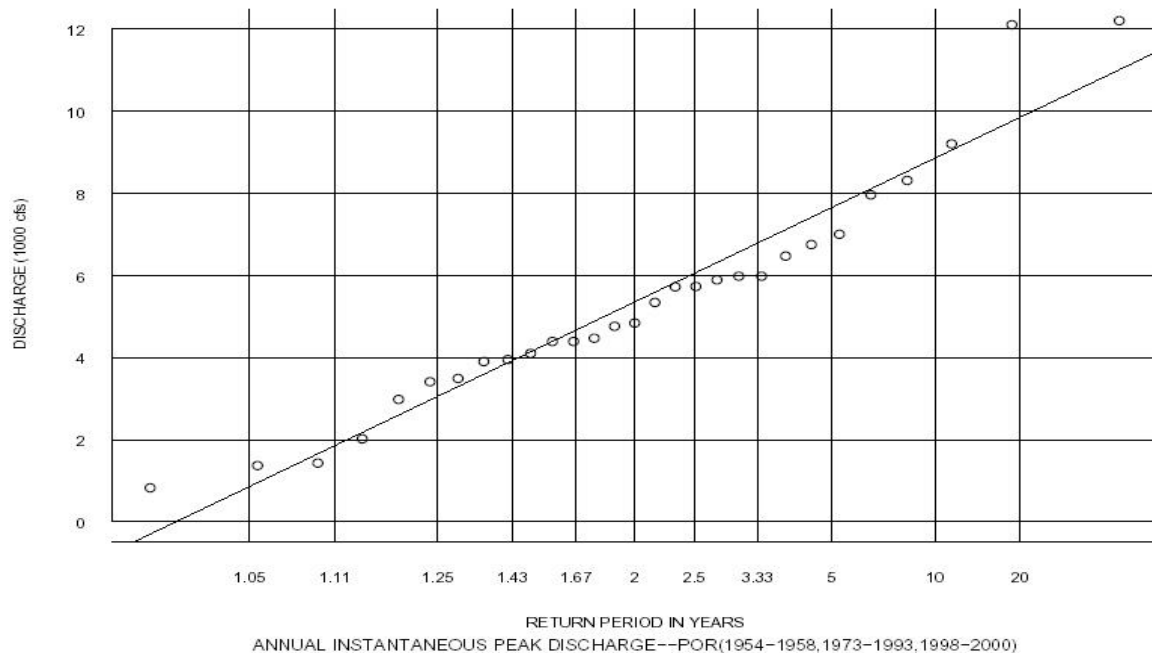


Table III-6: Seven-Day Running Average Of Low Flow And Frequency Analysis For The Period Of Record For "Redwood Creek At Orick", USGS Station #11482500.

LOW FLOW FRIQUENCY ANALYSIS Redwood Creek at Orick, STA#11482500 7 Day Minimum of Daily Mean. POR-(1912-1913.1954-2000)						
Ranked Data		Frequency Analysis				Statistics
Rank	Water Yr.	Discharge 7-Day Ave., cfs	Gringorten Plotting Position	Frequency	Exceedence Probability	Statistical Moments of Discharge
1	1988	2.21	87.71	0.989	0.011	Mean = 15.92 SDEV = 6.72 Variance = 4.51E+01 Skew = 0.29
2	1993	3.90	31.49	0.968	0.032	
3	1992	3.97	19.19	0.948	0.052	
4	1987	5.10	13.80	0.928	0.072	
5	1995	6.93	10.77	0.907	0.093	
6	1994	9.17	8.83	0.887	0.113	
7	1975	9.34	7.49	0.866	0.134	
8	1997	10.29	6.50	0.846	0.154	
9	1971	11.00	5.74	0.826	0.174	
10	1981	11.14	5.14	0.805	0.195	
11	2000	11.14	4.65	0.785	0.215	
12	1986	11.86	4.25	0.765	0.235	
13	1991	11.86	3.91	0.744	0.256	
14	1974	12.14	3.62	0.724	0.276	
15	1980	12.14	3.37	0.704	0.296	
16	1989	12.43	3.16	0.683	0.317	
17	1973	12.57	2.97	0.663	0.337	
18	1982	12.57	2.80	0.643	0.357	
19	1912	13.00	2.65	0.622	0.378	
20	1965	13.86	2.51	0.602	0.398	
21	1977	14.00	2.39	0.581	0.419	
22	1998	14.00	2.28	0.561	0.439	
23	1970	14.14	2.18	0.541	0.459	
24	1996	14.14	2.08	0.520	0.480	
25	1959	14.57	2.00	0.500	0.500	
26	1985	14.86	1.92	0.480	0.520	
27	1979	16.14	1.85	0.459	0.541	
28	1983	16.14	1.78	0.439	0.561	
29	1972	17.14	1.72	0.419	0.581	
30	1966	17.57	1.66	0.398	0.602	
31	1976	18.14	1.61	0.378	0.622	
32	1955	18.29	1.56	0.357	0.643	
33	1960	19.43	1.51	0.337	0.663	
34	1998	19.57	1.46	0.317	0.683	
35	1957	20.00	1.42	0.296	0.704	
36	1967	20.00	1.38	0.276	0.724	
37	1968	20.57	1.34	0.256	0.744	
38	1956	21.00	1.31	0.235	0.765	
39	1958	21.14	1.27	0.215	0.785	
40	1964	21.29	1.24	0.195	0.805	
41	1984	21.29	1.21	0.174	0.826	
42	1962	22.29	1.18	0.154	0.846	
43	1990	22.43	1.15	0.134	0.866	
44	1969	22.86	1.13	0.113	0.887	
45	1961	25.86	1.10	0.093	0.907	
46	1913	26.00	1.08	0.072	0.928	
47	1963	26.29	1.05	0.052	0.948	
48	1978	31.57	1.03	0.032	0.968	
49	1954	32.86	1.01	0.011	0.989	

Table III-7: Seven-Day Running Average Of Low Flow And Frequency Analysis For The Period Of Record For "Redwood Creek Near Blue Lake", USGS Station #11481500.

LOW FLOW FREQUENCY ANALYSIS Redwood Crk near Blue Lake, STA#11481500 7 Day Average Discharge PERIOD OF RECORD--WATER YEARS (1954-58,1973-93,1998-00)						
Ranked Data			Frequency Analysis			Statistics
Rank	Water Yr.	Discharge 7-Day Ave., cfs	Gringorten Plotting Position	Frequency	Exceedance Probability	Statistical Moments of Discharge
1	1993	1.0	52.00	0.981	0.019	Mean = 4.36 SDEV = 1.95 Variance = 3.79E+00 Skew = 0.46
2	1988	1.9	18.67	0.946	0.054	
3	1987	2.0	11.38	0.912	0.088	
4	1992	2.0	8.18	0.878	0.122	
5	2000	2.2	6.39	0.843	0.157	
6	1999	2.2	5.24	0.809	0.191	
7	1977	2.7	4.44	0.775	0.225	
8	1975	3.0	3.85	0.740	0.260	
9	1974	3.5	3.40	0.706	0.294	
10	1980	3.6	3.05	0.672	0.328	
11	1973	3.6	2.76	0.637	0.363	
12	1998	3.7	2.52	0.603	0.397	
13	1986	3.8	2.32	0.569	0.431	
14	1991	3.8	2.15	0.534	0.466	
15	1982	3.9	2.00	0.500	0.500	
16	1979	4.0	1.87	0.466	0.534	
17	1985	4.1	1.76	0.431	0.569	
18	1981	4.5	1.66	0.397	0.603	
19	1989	4.7	1.57	0.363	0.637	
20	1978	5.7	1.49	0.328	0.672	
21	1976	5.7	1.42	0.294	0.706	
22	1983	5.9	1.35	0.260	0.740	
23	1958	6.1	1.29	0.225	0.775	
24	1984	6.2	1.24	0.191	0.809	
25	1955	6.4	1.19	0.157	0.843	
26	1990	6.7	1.14	0.122	0.878	
27	1957	6.7	1.10	0.088	0.912	
28	1956	7.4	1.06	0.054	0.946	
29	1954	9.2	1.02	0.019	0.981	

Chart III-13: Seven-Day Running Average Of Low Flow, Calculated From The Mean Of The Daily Mean, And The 5-Point Moving Average For The Period Of Record For "Redwood Creek At Orick", USGS Station #11482500.

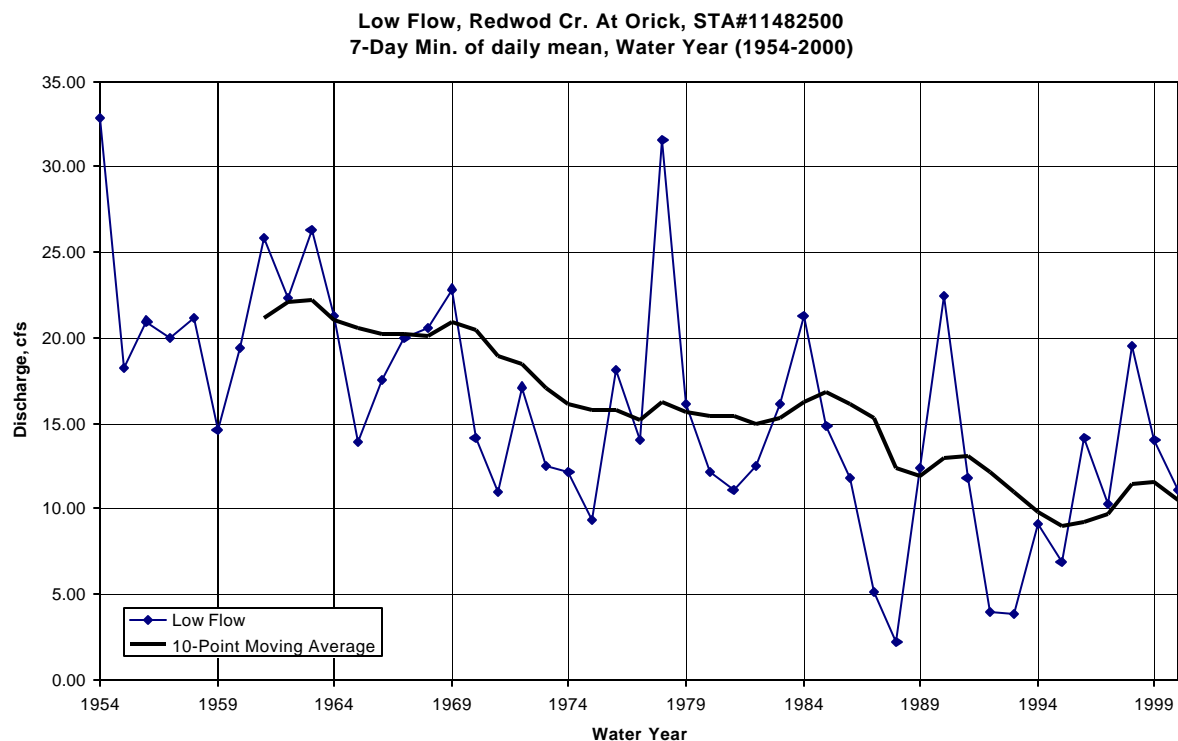


Chart III-14: Seven-Day Running Average Of Low Flow, Calculated From The Mean Of The Daily Mean, And The 5-Point Moving Average For The Period Of Record For "Redwood Creek Near Blue Lake", USGS Station #11481500.

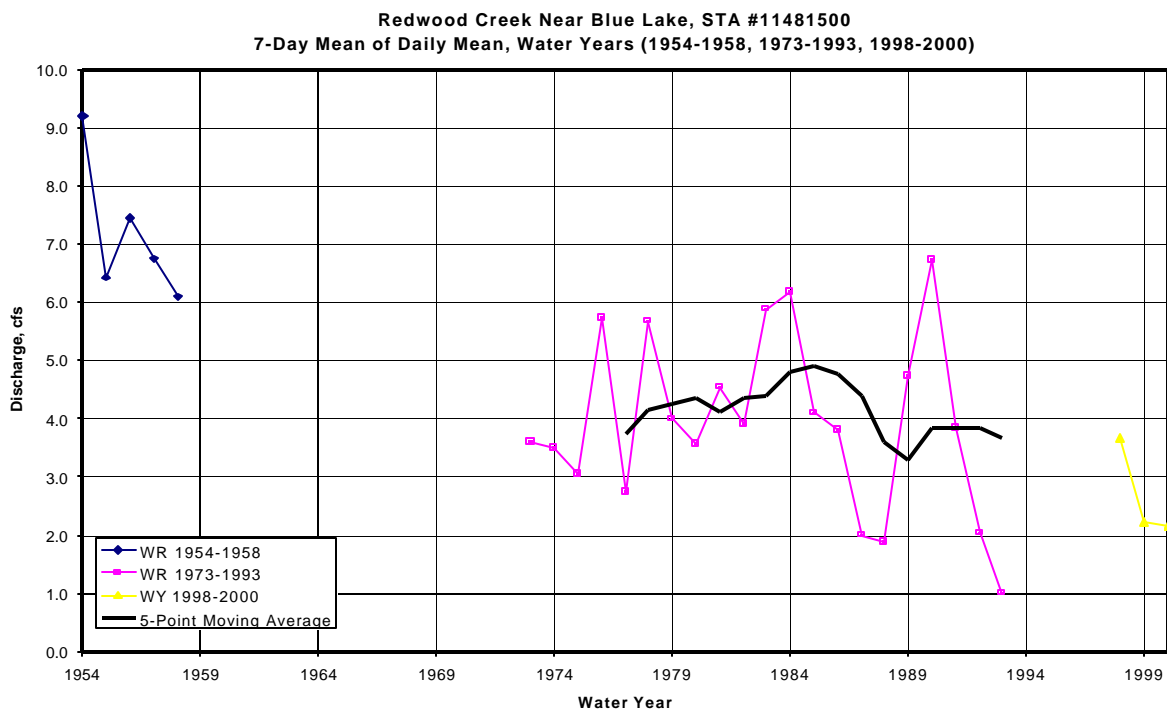


Chart III-15: Low-Flow Return Period For The Period Of Record. Graph Shows The Theoretical Return Period In Years That A Given Value Will Be Equaled Or Exceeded. "Redwood Creek At Orick", USGS Station #11482500.

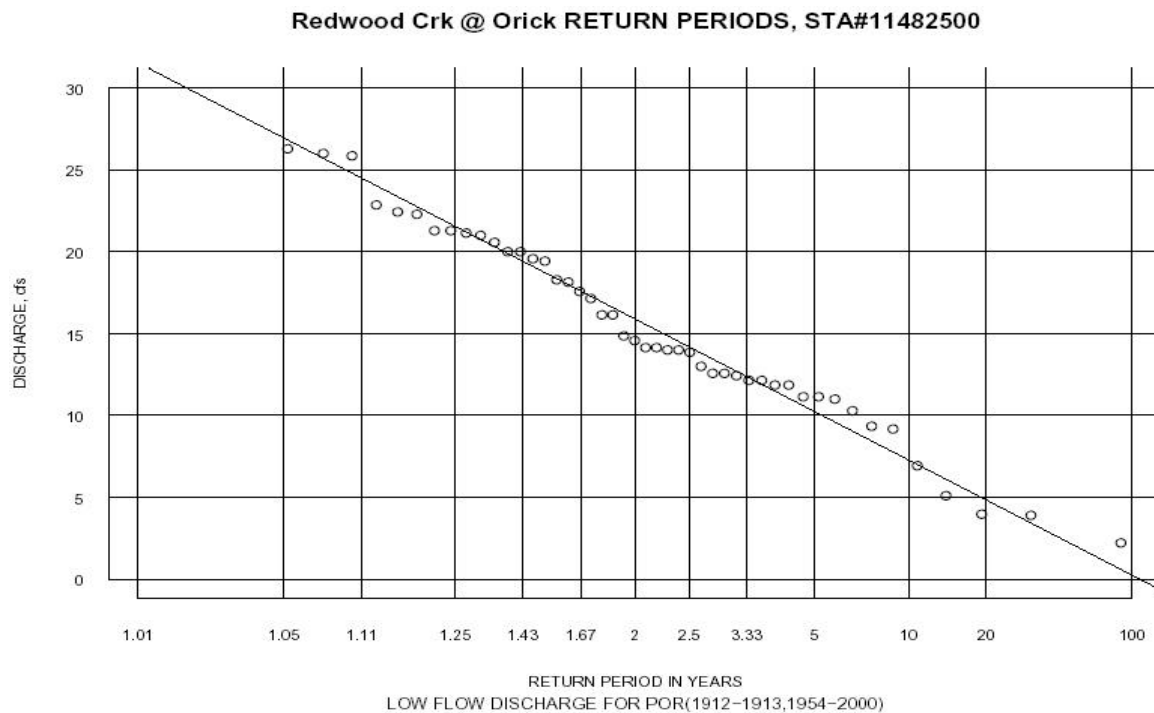
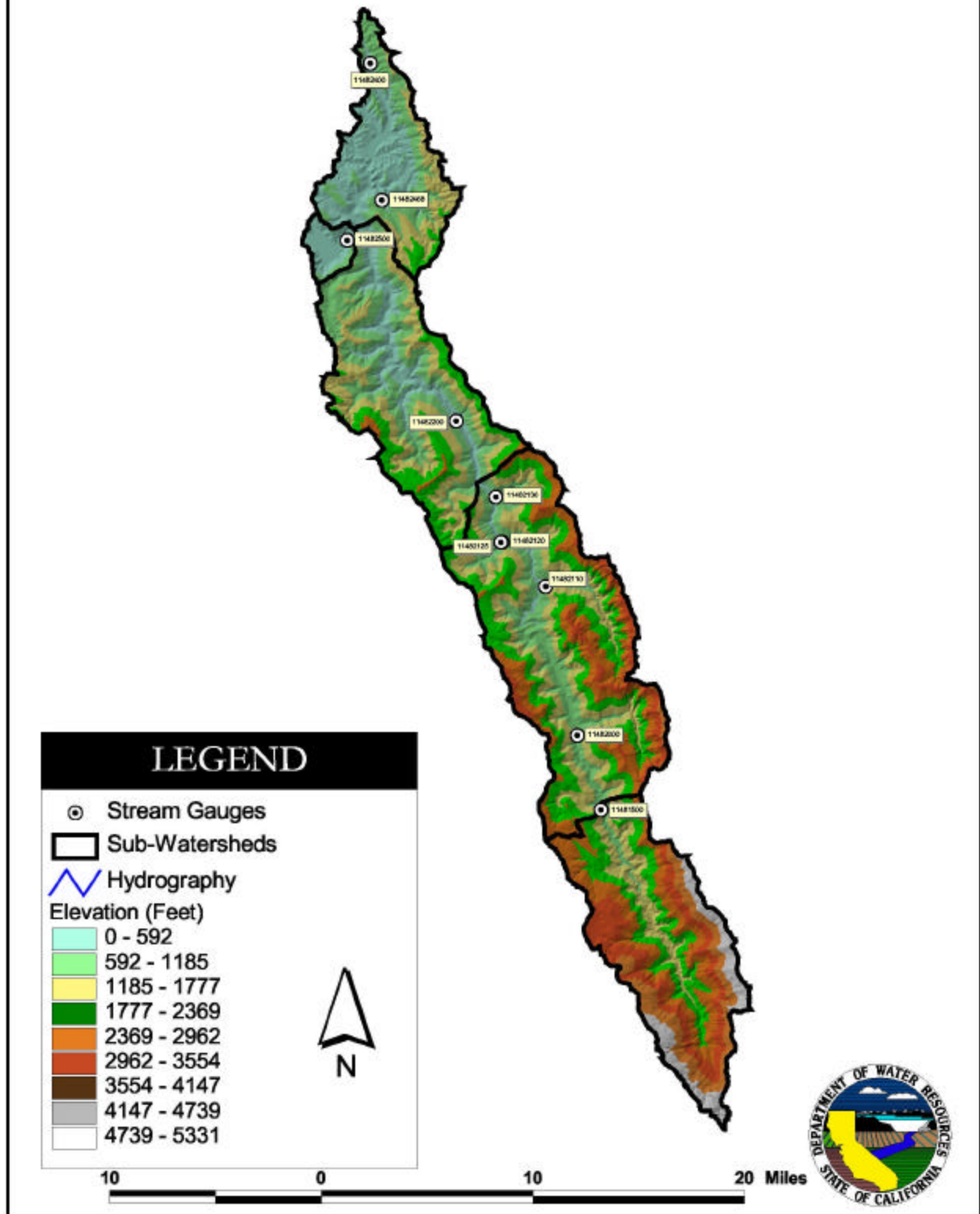


Chart III-16: Low-Flow Return Period For The Period Of Record. Graph Shows The Theoretical Return Period In Years That A Given Value Will Be Equaled Or Exceeded. "Redwood Creek Near Blue Lake, USGS Station #11481500.



**Figure III-1
Redwood Creek
Stream Gauge Location Map**



IV. SURFACE WATER RIGHTS AND WATER USE

California law recognizes various types of water rights to surface water flow. Their proof of existence and exercise can often be a complicated and controversial issue. Surface water diversions can have a major impact on stream flow and consequently fisheries habitat. Ground water extractions, with a few exceptions, are not subject to California law and can also affect stream flow. A description of the different types of surface water rights can be found at the State Water Resources Control Board (SWRCB) web site (waterrights.ca.gov). A more detailed description is published in an article in the Pacific Law Journal, Volume 19, and Issue 4, entitled "Overview of California Water Law" by William R. Atwater and James Merkle.

The two predominate types of water rights within the Redwood Creek watershed are riparian and appropriative. The pueblo water right, distinctly recognized by California water law, is very rare and pertains to the right of a city, as the successor of a Spanish or Mexican pueblo (municipality), to the use of water naturally occurring within the old pueblo limits for the use of the inhabitants (Hutchins, 1956). This type of water right has not been established within the Redwood Creek watershed and is not discussed further.

Riparian water rights generally apply to the diversion and use of surface water from a natural watercourse on lands that the watercourse passes through or borders. No California statute defines riparian rights and a State permit is not required, but a riparian water rights doctrine has been established in the State by decisions of the courts and confirmed by Section 3, Article XIV of the California constitution.

Common restrictions and conditions that apply to all riparian water rights include: 1.) the diversion of water is limited to natural flowing water as distinguished from return flows derived from the use of ground water, water seasonally stored and later released, or water diverted from another watershed; 2.) a parcel of land loses its riparian right if it is severed from the land bordering the watercourse unless the right is reserved by deed for the severed parcel; 3.) they are of equal priority with all other riparian rights to the same natural flow of a watercourse regardless of the date of initial use; 4.) they are neither created by use nor lost by nonuse; 5.) they can not be transferred to another parcel of land but can be dedicated to instream flow purposes; 6.) a "Statement of Water Diversion and Use" is required, with certain exceptions, to be filed periodically with the SWRCB. This statement establishes a record of actual water use.

Appropriative water rights generally apply to the diversion and use of water on lands that do not border the watercourse. Appropriative water rights are divided into two types, those initiated before December 1914 (pre-1914) and those initiated after December 1914 (post-1914).

Prior to enactment of the California Water Commission Act in December 1914, the appropriation of water from surface streams was obtained in accordance with the guidelines in Sections 1410 through 1422 of the California Civil Code of 1872. To appropriate water, it was necessary to post a notice at the proposed point of diversion and record a copy of the notice with the respective county recorder. The right was considered valid as long as the appropriator maintained continuous beneficial use of the water. The amount that could be rightfully claimed was fixed by actual beneficial use as to both amount and season of diversion.

In 1914, the California Water Commission Act abolished the procedures previously followed for water appropriation, and established an application process. Water appropriation now requires compliance with the provisions of Division 2, Part 2 of the California Water Code. These provisions established the steps

that must be followed to initiate and acquire an appropriative water right. The purpose of filing an application for a permit is to secure a right to the use of unappropriated water and to establish a record of the right so that its status relative to other rights may be determined.

A prospective appropriator must file an application with the SWRCB. The application includes all information pertinent to the development, acquisition, and use of the water, including point of diversion, diversion flow rates, time of diversion, quantity of diversion, and place and purpose of use. The application is then reviewed by the SWRCB. The review process includes: 1.) posting or publication of the application. If protests are received, a hearing or investigation is conducted; 2.) availability of unappropriated water; 3.) possible environmental impacts as required by the California Environmental Quality Act; 4.) possible fisheries impacts by the California Department of Fish and Game.

Although ground water extractions do not generally require a SWRCB application, underground water extractions from "subterranean streams flowing through known and definite channels" are under the SWRCB jurisdiction and are subject to the same review as surface water extractions.

If the application is approved, a permit is issued with terms and conditions to develop the diversion facilities. If the terms and conditions are completed and adhered to during a specific time frame, a license is issued limiting the water user to a quantity of water that was demonstrated as beneficially used during the permitting process. The terms and conditions set by the SWRCB normally apply after the license is issued.

Common conditions and restrictions that apply to all pre-1914 and post-1914 appropriative water rights include: 1.) appropriation of water can be from the natural flow of a watercourse, return flows derived from the use of surface or ground water, water seasonally stored and later released, or water diverted from another watershed; 2.) they can be transferred to other lands or for instream flow purposes; 3.) they typically follow the "first in time, first in right" doctrine of priority among other appropriators but are inferior to riparian water rights. There may be times during the diversion season when no unappropriated water is available; 4.) they can be lost after five years of nonuse; 5.) a "Statement of Water Diversion and Use" is required, with certain exceptions, to be filed periodically with the SWRCB. This statement provides a record of actual water use.

Disputes over the exercise of surface water rights occur and can occasionally only be resolved by court litigation. The SWRCB is authorized to pursue civil action if a water user violates the terms of a post-1914 appropriative water right, but does not have the authority to determine the validity of other vested water rights. The County Superior Courts are sometimes compelled to adjudicate water rights as a result of disputes that can not be resolved by other methods. A typical water right adjudication defines numerous aspects of the water rights involved including the quantity of use, priority to other vested water rights, point of diversion, and the purpose, place and season of use. Court adjudicated water rights do not currently exist within the Mattole watershed.

A search of the SWRCB's Water Right Information System (WRIMS) was performed to determine the number and types of water rights within the Redwood Creek watershed. The WRIMS database is under development and may not contain all post-1914 appropriative water right applications that are on file with the SWRCB at this time. Some pre-1914 and riparian water rights are also contained in the WRIMS database for those water rights whose users have filed a "Statement of Water Diversion and Use". A list of

water rights and associated information contained within WRIMS for the Redwood Creek watershed is presented in Table IV-1. A location map of the point of diversion is shown in Figure IV-1.

According to Table IV-1, SWRCB appropriative water right permits exist for a total of about 780 acre-feet per year (ac-ft/yr) of water from the Redwood Creek watershed, at a maximum diversion rate of about 1.1 cubic feet per second (cfs). Riparian and pre-1914 appropriative water rights for those water users who have filed a "Statement of Water Use" total about 370 ac-ft/yr, at a maximum rate of about 0.5 cfs.

The California Department of Water Resources (DWR) periodically conducts land and water use surveys for the basin as part of its Statewide Planning Program. Aerial photographs at a scale of 1:24000 are used to identify land use types. Crop type and water source are then determined or verified by field inspection. DWR uses this data to estimate agricultural water use during an average water supply year and future water use demands for each detailed analysis unit (DAU) of the State and publishes the information in the Bulletin 160 series. The latest land use survey was conducted in 1996. Table IV-2 presents DWR agricultural acres, water source, and estimated water use data for the Redwood Creek watershed (DAU #28) for 1996.

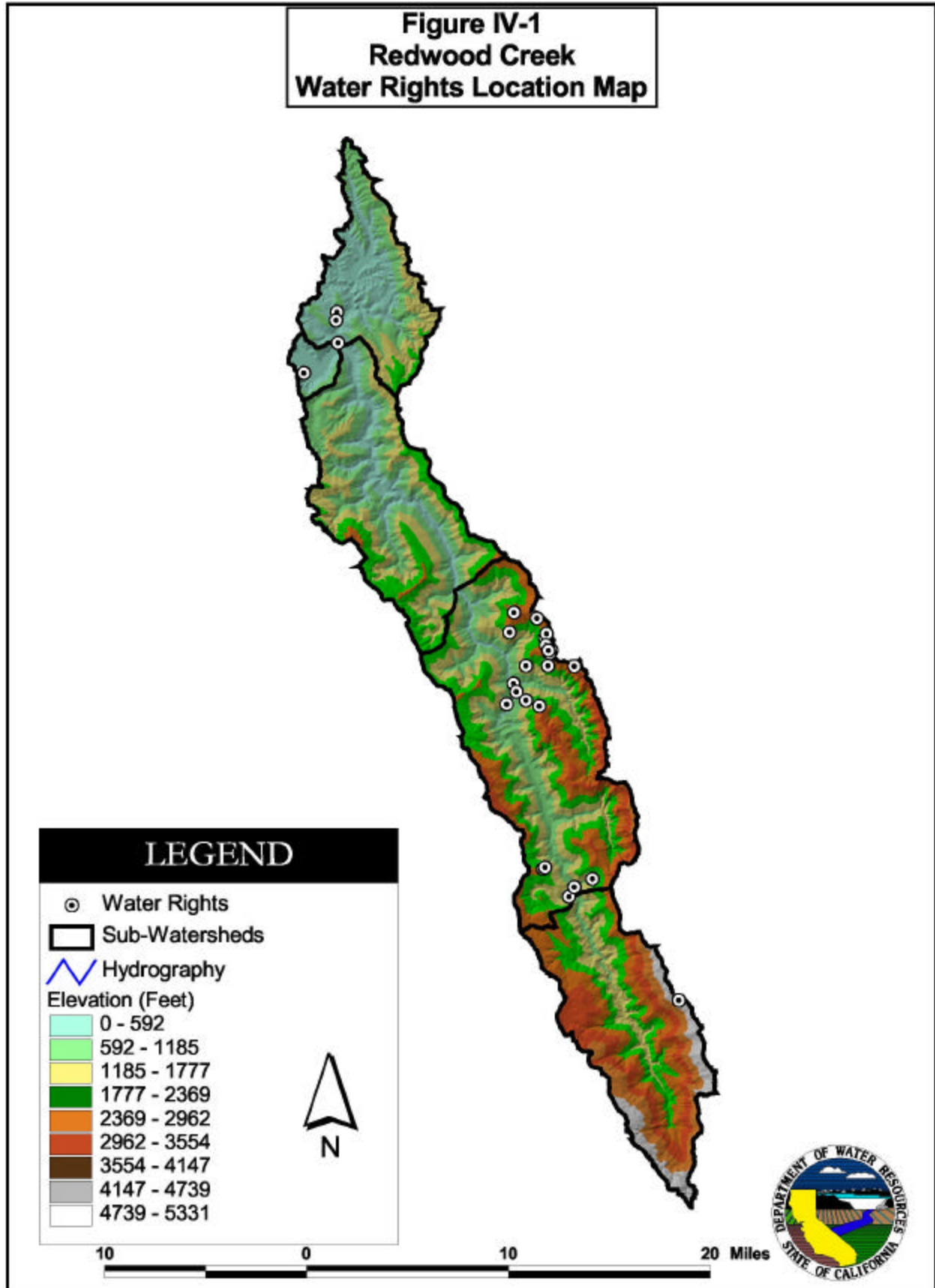
Table IV-2: Agricultural land, water source, and water use within the Redwood Creek watershed.

REDWOOD CREEK WATERSHED AGRICULTURAL LAND AND WATER USE FOR 1996									
Crop	Water Source (gross acres)				Unit Applied Water (acre-feet per acre)		Water Use (acre-feet per year)		
	Dry	Ground	Surface	Total	Ground	Surface	Ground	Surface	Total
Pasture	663	321	0	984	2.0	na	640	0	640
Potatoes	1	0	0	1	na	na	0	0	0
Total	664	321	0	985	na	na	640	0	640

Due to the steep mountainous terrain and most of the watershed being owned by private lumber companies or the U. S. Park Service, surface water diversions for commercial irrigated agriculture are essentially nonexistent today and are expected to remain so in the future. Water extraction for residential use also appears to be minimal. DWR also estimates water use for municipal and industrial purposes for the Bulletin 160 series. Table IV-3 presents DWR population and estimated water use the years 1995 and 2020.

Table IV-3: Population and water use within the Redwood Creek watershed

REDWOOD CREEK WATERSHED POPULATION AND WATER USE DWR Detailed Analysis Unit #28				
Year	Permanent Population	Water Use (acre-feet per year)		
		Surface Water	Ground Water	Total
1995	1,000	0	88	88
2020	1,060	0	93	93.0
Total		0	181	181



Preliminary: Subject to revision

TABLE IV-1

REDWOOD CREEK

LIST OF WATER RIGHTS CONTAINED IN THE STATE WATER RESOURCES CONTROL BOARD WATER RIGHT INFORMATION MANAGEMENT SYSTEM (WRIMS) DATABASE

	1/ WRIMS ID	2/ Owner	3/ Type	Application Number	Application Date	Permit Number	Permit Date	License Number	License Date	Source	Tributary To	Maximum Annual Diversion Volume (acre-feet/year)	Maximum Diversion Rate	4/ Purpose of Use	5/ POD Location	County
1	A005097	Harry Jackson	A	005097	7/12/96	002803	6/7/27	000927	11/17/30	Green Point Cr.	Redwood Cr.	(no data)	0.28 cfs	I	SE NE, 15, 6N, 3E, H	Humboldt
2	A012653	Marion Lamar	A	012653	8/16/48	007500	9/30/49	003749	6/1/53	Captain Cr.	Redwood Cr.	(no data)	14,000 gpd	D, I	SW SW, 11, 6N, 3E, H	Humboldt
3	A012654	Jerry Carlson	A	012654	8/16/48	007501	9/30/49	004706	9/19/57	Captain Cr.	Redwood Cr.	(no data)	5,760 gpd	D	SW SE, 11, 6N, 3E, H	Humboldt
4	A014669	Dale Shelton	A	014669	2/11/52	008979	5/13/52	005906	12/7/59	unnamed spring	unnamed stream	(no data)	3,000 gpd	D	SE NE, 5, 10N, 1E, H	Humboldt
5	A019021	Arcata Redwood Co.	A	019021	10/8/59	012242	3/11/60	007441	9/2/65	Prairie Cr.	Redwood Cr.	(no data)	10,000 gpd	E, J	SW SE, 27, 11N, 1E, H	Humboldt
6	A020776	Carl Boettcher	A	020776	5/17/62	013785	12/5/62	009405	6/5/70	unnamed spring	unnamed stream	(no data)	1,000 gpd	D	NE SE, 11, 6N, 3E, H	Humboldt
7	A022016	Arcata Redwood Co.	A	022016	1/4/65	014891	10/28/65	009056	3/21/69	Prairie Cr.	Redwood Cr.	(no data)	0.054 cfs	E, J	SW SE, 27, 11N, 1E, H	Humboldt
8	A024732	Orick Community Service Dist.	A	024732	12/30/74	016790	6/3/76	none	na	Redwood Cr. under flow	Pacific Ocean	112	0.232 cfs	M	SE SE, 33, 11N, 1E, H	Humboldt
9	A025436	Ruby Valley Mut. Water Co.	A	025436	7/19/77	017577	3/16/79	011769	3/25/85	unnamed stream	Redwood Cr.	13.5	0.04 cfs	D	SW SE, 9, 4S, 3E, H	Humboldt
10	A029681	Margret Cole	A	029681	3/7/90	020930	8/21/97	none	na	unnamed stream	Redwood Cr.	40.7	0.139 cfs	D, I	NW NE, 9, 6N, 3E, H	Humboldt
11	A029681	Margret Cole	A	029681	3/7/90	020930	8/21/97	none	na	unnamed stream	unnamed stream	40.7	0.139 cfs	D, I	SW SE, 4 6N, 3E, H	Humboldt
12	A029681	Margret Cole	A	029681	3/7/90	020930	8/21/97	none	na	unnamed stream	Redwood Cr.	40.7	0.139 cfs	D, I	SW SE, 4 6N, 3E, H	Humboldt
13	D030817R	Richard Wolf	D	030817R	12/7/98	na	na	000423R	3/29/99	Redwood Cr.	Pacific Ocean	5	4,500 gpd	D	NW NE, 31, 8N, 3E, H	Humboldt
14	F01106S	U. S. Six Rivers Nat. Forest	F	01106S	12/1/82	none	na	none	na	Cold Springs	unnamed stream	(no data)	180 gpd	S, W	SE NW, 10, 5N, 4E, H	Humboldt
15	S008647	CA Dept of Parks & Rec.	S	008647	1/1/75	na	na	na	na	unnamed stream	Prairie Cr.	(no data)	43 gpd	Z	NW NW, 33, 12N, 1E, H	Humboldt
16	S009947	Diana Kriger	S	009947	7/5/79	na	na	na	na	Redwood Cr.	Pacific Ocean	(no data)	(no data)	D	NE, 31, 8N, 3E, H	Humboldt
17	S013252	Robert Davison	S	013252	9/8/89	na	na	na	na	unnamed stream	Prairie Cr.	(no data)	0.111 cfs	I, J	SW NE, 22, 11N, 1E, H	Humboldt
18	S013253	Betty Davison	S	013253	9/8/89	na	na	na	na	unnamed stream	Prairie Cr.	(no data)	0.223 cfs	I, J	SE SW, 22, 11N, 1E, H	Humboldt
19	S013509	Stover Ranch Ltd.	S	013509	6/26/90	na	na	na	na	Redwood Cr.	Pacific Ocean	(no data)	0.078 cfs	S	NE NE, 30, 8N, 3E, H	Humboldt
20	S013510	Stover Ranch Ltd.	S	013510	6/26/90	na	na	na	na	unnamed spring	Redwood Cr.	(no data)	2,880 gpd	D, I, S, W	SW NW, 29, 8N, 3E, H	Humboldt
21	S013511	Stover Ranch Ltd.	S	013511	6/26/90	na	na	na	na	unnamed stream	Stover Cr.	(no data)	5,400 gpd	D, I, S, W	SE SW, 29, 8N, 3E, H	Humboldt
22	S013513	Stover Ranch Ltd.	S	013513	6/26/90	na	na	na	na	unnamed spring	Garrett Cr.	(no data)	4,320 gpd	S	SE SE, 5, 8N, 3E, H	Humboldt
23	S013514	Stover Ranch Ltd.	S	013514	6/26/90	na	na	na	na	unnamed spring	Coyote Cr.	(no data)	5,400 gpd	S	NE SE, 6, 8N, 3E, H	Humboldt
24	S013515	Stover Ranch Ltd.	S	013515	6/26/90	na	na	na	na	unnamed spring	Garrett Cr.	(no data)	7,200 gpd	S	SW NE, 7, 8N, 3E, H	Humboldt
25	S013516	Stover Ranch Ltd.	S	013516	6/26/90	na	na	na	na	unnamed spring	Garrett Creek	(no data)	720 gpd	D	SE SW, 9, 8N, 3E, H	Humboldt
26	S013517	Stover Ranch Ltd.	S	013517	6/26/90	na	na	na	na	unnamed spring	Garrett Creek	(no data)	1080 gpd	S	NE SW, 9, 8N, 3E, H	Humboldt
27	S013519	Stover Ranch Ltd.	S	013519	6/26/90	na	na	na	na	unnamed spring	Garrett Creek	(no data)	1440 gpd	S	NW NE, 16, 8N, 3E, H	Humboldt
28	S013520	Stover Ranch Ltd.	S	013520	6/26/90	na	na	na	na	unnamed spring	Lacks Creek	(no data)	2707 gpd	S	SE NE 16, 8N, 3E, H	Humboldt
29	S013521	Stover Ranch Ltd.	S	013521	6/26/90	na	na	na	na	unnamed spring	Lacks Creek	(no data)	14440 gpd	S	NW SE, 16, 8N, 3E, H	Humboldt
30	S013522	Stover Ranch Ltd.	S	013522	6/26/90	na	na	na	na	unnamed spring	Garrett Creek	(no data)	1440 gpd	S	SW NW, 16, 8N, 3E, H	Humboldt
31	S013523	Stover Ranch Ltd.	S	013523	6/26/90	na	na	na	na	unnamed spring	Lacks Creek	(no data)	650 gpd	S	NW NE, 20, 8N, 3E, H	Humboldt
32	S013524	Stover Ranch Ltd.	S	013524	6/26/90	na	na	na	na	unnamed spring	Lacks Creek	(no data)	2160 gpd	D	NW NE, 21, 8N, 3E, H	Humboldt
33	S013525	Stover Ranch Ltd.	S	013525	6/26/90	na	na	na	na	unnamed spring	Lacks Creek	(no data)	10800 gpd	S	NE NE, 22, 8N, 3E, H	Humboldt
34	S013526	Stover Ranch Ltd.	S	013526	6/26/90	na	na	na	na	unnamed spring	Lacks Creek	(no data)	4320 gpd	S	NW NW, 33, 8N, 3E, H	Humboldt
Notes: 1/ State Water Resources Control Board water right identification																
2/ Current WRIMS owners name. May not be current owner of property.																
3/ A = SWRCB appropriative water right, C = stockwater pond, D = small domestic registration, F = Federal filing, S = pre-1914 appropriative water right or riparian water right																
4/ D = domestic, E = fire protection, I = irrigation, J = Industrial, M = municipal, R = recreation, S = stockwatering, W = fish & wildlife protection or enhancement, Z = other																
5/ Point of diversion location. Quarter-Quarter Section, Section, Township, Range, Base & Meridian (M = Mount Diablo; H = Humboldt)																